FACTORY

BETTER PRODUCTION AND MAINTENANCE THROUGH BETTER MANAGEMENT

FACTORY watercolor: Allen Manufacturing Company's efficient new plant at Bloomfield, Conn.

SEPTEMBER 1959

PRICE ONE DOLLAR

A McGRAW-HILL PUBLICATION

WORK SAMPLING TODAY..... p. 122

New and better ways to use it in your plant

HOW TO ORGANIZE FOR BETTER MAINTENANCE.....p. 109

HOW TO GET MORE OUT OF TWO-WAY RADIO.....p. 272

Two ways of providing
EXPOSURE PROTECTION

TOO LATE ▲
to prevent serious heat exposure, a valiant attempt is made by firefighters to prevent rupture of tankage, not already involved in flames, with relatively ineffective hose streams.

GRINNELL WATER SPRAY SYSTEM ▶
shown under test at the Marietta, Ohio plant of the Bakelite Union Carbide Plastic Company, a division of the Union Carbide Corporation. Water – when it is applied in time and distributed over the surfaces efficiently by a properly engineered system – is most effective in limiting tank fires and controlling their spread.

Proper safeguards are uppermost in importance in protecting tanks which contain gases and flammable liquids in the event of fire. For example, tanks must be guarded against extreme heat exposure. Leaking gas, if it should develop, must be diluted to the point where it will not burn. And fire, if it should occur, must be localized and controlled or extinguished.

With a Grinnell Water Spray System, you get protection against all these eventualities.

Before heat raises tank temperatures dangerously, an enveloping spray of water provides instant cooling, reducing internal pressure which helps prevent rupture. In addition, air turbulence is created (even in still air) which, in conjunction with the water vapor from the spray, helps dilute the flammable vapors controlling or extinguishing the fire. Flammable products which cannot be safely extinguished can be burned off under the protecting water spray with no damage to adjacent protected equipment.

There is a Grinnell Fire Protection System for every fire hazard. Call on Grinnell for advice about the one suited to your needs. Grinnell Company, Inc., 277 West Exchange Street, Providence 1, R. I.

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B.F.Goodrich V belts now have 40% greater horsepower rating

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THE MAGAZINE OF PLANT OPERATING MANAGEMENT

Edited exclusively for the men with management responsibility for production and maintenance in the manufacturing industries

PROBLEM-SOLVING GUIDE

THIS SIMPLE FILING SYSTEM is designed to give quick access to past FACTORY articles that can help you solve current operating problems. Here's how it works:

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1.1 Management and Practices

1.2 Buildings and Yards

1.3 Services and Facilities

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Get The Facts On
ELPAR LEASING

"Titan" Heavy Duty Fork Trucks

You can use ELPAR Leasing to put one of these cost cutting ELPAR industrial trucks to work in your plant immediately! Do it without a major cash outlay . . . and, pay the low monthly payments out of savings created by the new truck.

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For more facts Circle 449 on Reader Service Card

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This Standard Oil product made better grinding possible at Cessna

Aircraft Company's Industrial Products Division licked three problems with ARGON Oil No. 4

Situation: A fluid used in grinding operations at this Cessna plant at Hutchinson, Kansas, was creating three problems:

1) It washed the lubricant from regulator wheels and grinding fixtures, causing them to freeze.
2) It caused build-up of deposits.
3) It stripped paint from machine surfaces.

What was done: Cessna management called in a Standard Oil lubrication specialist who recommended ARGON Oil No. 4 in ratios of 100 and 150:1 for test. The coolant was tested in two centerless grinders for two months.

What happened: All three conditions which were hampering operations were cleared up when the switch was made to ARGON Oil No. 4. Cessna also found that work remained rust-free after passing through the machines, something that had not been the case before. They also found that the coolant didn't foam. With no foam, more of it stayed on the wheel, resulting in cooler operation. Faster cuts were obtained with finer wheels. All 12 grinders in the Cessna shop were then converted to ARGON Oil No. 4.

What you can do: Get more facts about ARGON Oil No. 4 from the Standard Oil office near you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

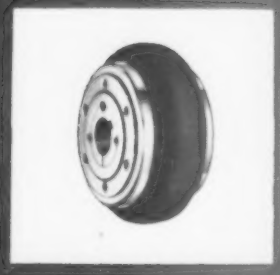
Quick facts about **ARGON Oil No. 4**

• Clear, transparent fluid • Able to control corrosion and rust on work and machines • All chemical. Does not support bacteria growth • Unaffected by humidity • Fire resistant • Odorless

Jerry Croes, Standard Oil staff engineer, Paul Hoyer, Cessna section superintendent and Bill Ray, Standard Oil lubrication specialist (l. to r.) inspect rust-free finish after grinding with ARGON Oil No. 4 while J. E. Petrie (far left), operator, looks on. Both Jerry Croes and Bill Ray have plenty of experience in this sort of work. Jerry has been at it for 16 years. He has an engineering degree from South Dakota School of Mines & Technology and has completed the Standard Oil Sales Engineering School. Bill has six years service working with industrial customers.

You expect more from **STANDARD** *and you get it!*

Up to 625 hp



NOW! THE COUPLING WITH THE 4-WAY FLEX!

DODGE Para-flex

FLEXIBLE CUSHION COUPLING

THE NEW IDEA IN FLEXIBLE COUPLINGS... WITH A FLEXING BODY THAT AUTOMATICALLY COMPENSATES FOR ALL COMBINATIONS OF MISALIGNMENT AND END FLOAT... AND CUSHIONS SHOCK LOADS!

THIS Coupling "swallows up" misalignment! Its ability to handle multiple displacement is exceeded only in a universal joint. It outperforms the most complex coupling mechanisms—yet it operates with the simplicity—*and the dependability*—of a modern tire!

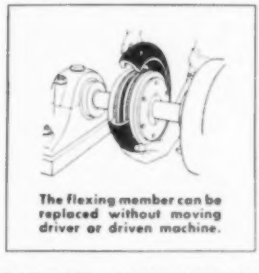
The technological advances that contribute to the miracle of today's truck tires, which are engineered to carry tremendous loads at high speeds and stand terrific shock, have made this new type of coupling possible.

The heart of Para-flex is a tire with synthetic tension members bonded together in rubber. It is pliant. It "fits itself" to changing shaft conditions—angular, parallel, end-float, *or any combination of all three!* Depending upon the size of coupling and duration of shaft misplacement, it handles angular misalignment up to 4°, parallel up to ⅛" and end-float up to 5/16".

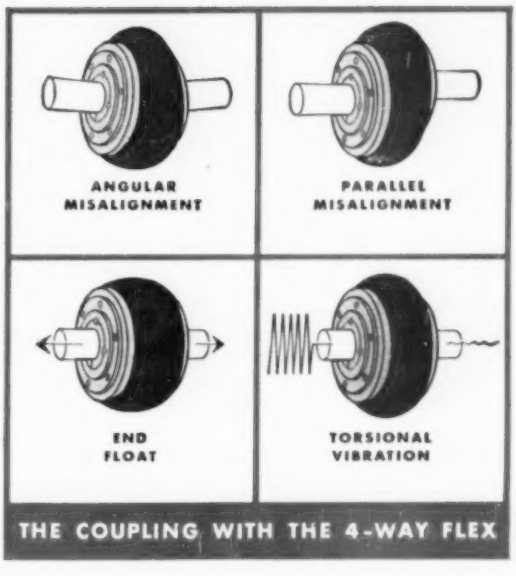
It cushions the stresses of shock loads to a remarkable degree. And it tends to absorb torsional vibration—reducing noise and protecting machinery from vibration's destructive forces.

There is no metal-to-metal contact between shafts. They are insulated. No lubrication is required.

Para-flex takes a minimum of space on the shaft. Mounting is simplified through the use of standard Taper-Lock bushings—no reboring, no machining. Safety is promoted by flush design; there are no protruding parts. And since the flexible member is molded with a transverse split, it can be replaced *without moving either the driver or driven machine!*



The flexing member can be replaced without moving driver or driven machine.



THE COUPLING WITH THE 4-WAY FLEX

Para-flex Couplings are stocked by Dodge Distributors in popular transmission sizes. They are available from factory stock in capacities up to 825 hp at 1200 rpm. Call your distributor for early delivery to *make your own test.* You'll witness something revolutionary!

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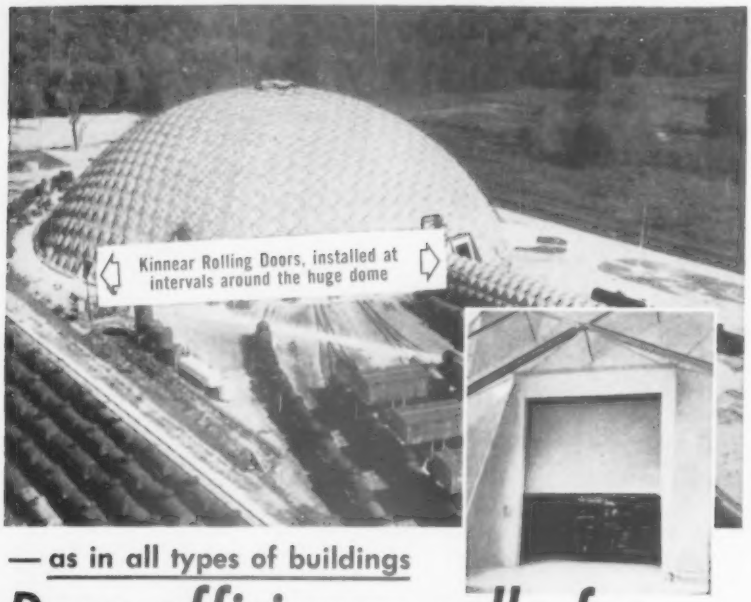
Even in this ultra-modern geodesic dome—



— as in all types of buildings

Door efficiency calls for Kinnear Rolling Doors

With no internal supports of any kind, *yet big enough to enclose a football field,* this giant geodesic dome houses a railroad car repair shop of the Union Tank Car Co., in Baton Rouge, La.

And here, as in all types of buildings, Kinnear Rolling Doors provide up-to-the-minute door efficiency.

They open straight upward and clear the entire doorway, coiling compactly above the opening. Surrounding floor, wall and overhead space, *inside and outside the building* is always fully usable whether the doors are opened, closed, or in action. This promotes full use of hoist, crane, conveyor, and lift-truck equipment.

Their *continuous all-metal curtain* gives extra protection against intruders, vandals, troublemakers, wind, weather, and fire.

Every Kinnear Door is *Registered.* Full details of all parts are kept permanently in Kinnear's fire-proof vaults. Parts are always replaceable. Your Kinnear doors will never be "orphans".

For maximum durability Kinnear's special hot-dip galvanizing coats the entire curtain with a full *1.25 oz. of pure zinc per square foot of metal* (ASTM standards).

Kinnear Rolling Doors are built any size, for old or new buildings, with motor, manual or mechanical operation. Write for information.

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KINNEAR
ROLLING DOORS
Saving Ways in Doorways

FACTORY LETTERS

TWO PATS ON BACK

Sir:

I have read the article in the June issue of FACTORY (page 222), entitled "How a Pro Looks at Maintenance Cost Reduction," and wish to congratulate you on the excellent presentation. I fully agree with everything you said and consider it the best article of a general nature that I have read, even including others published by FACTORY.

E. N. Coulthart
Asst. General Superintendent
Mechanical Division
Aluminum Co. of Canada, Ltd.
Arvida, Que.

Sir:

I have just finished reading your interesting article ("How a Pro Looks at Maintenance Cost Reduction") in your June issue. This took me back a few years when I was actively engaged in maintenance work. You sure have covered the main points in connection with the modern concept of handling maintenance in a sizable industrial plant.

H. L. Hayden
Manager, Doyle Works
Polychemicals Dept.
E. I. duPont de Nemours & Co., Inc.
Leominster, Mass.

► We appreciate your nice comments about Carl Wyder's article. It's always encouraging to know that our material rings the bell. Readers

Turn the page

FACTORY
September 1959 Vol. 117, No. 9

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TOWMOTOR TOWMOSTATIC DRIVE . . . This instant foot controlled power application available on Towmotor Models 421, L461, 461 and 501, introduces a new era in fork lift truck operation. (Model 421-LP illustrated)

Touch pedal...not lever...to go!

With Towmostatic Drive *simply apply* toe pressure for forward movements—heel pressure to reverse! That's all!

It's the *first*—and it's making history! *Towmostatic Drive* now lets Towmotor lift truck operators control *all* forward and reverse travel with one foot, on a treadle-type pedal. This revolutionary method of power application gives industrial management a *new starting point* in material handling economies.

You simplify lift truck operation—reduce hand movement—get simultaneous "inching" and load positioning—promote safety. You cut maintenance costs to bedrock because transmission, drive line and other conventional mechanisms are eliminated. You lower profit-robbing downtime!

To see how this new engineering achievement now opens the door to extra efficiency in factory, mill and warehouse handling operations, write for *Towmostatic Drive Booklet*. Address Towmotor Corporation, Cleveland 10, Ohio.

TOWMOTOR ® **THE ONE-MAN-GANG** — **GERLINGER**

LEADER FOR 40 YEARS IN BUILDING FORK LIFT TRUCKS, CARRIERS AND TRACTORS

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See LOCAL SOURCES Section This Issue

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BY

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A65

FURNAS

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

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Begins on page 8

who may be interested in reprints of this article can get them at 35¢ a copy. Write to Reader Service Dept., FACTORY, 330 West 42nd St., New York 36.—ED.

TIME TO LEARN

Sir:

The March 1959 issue of FACTORY has just crossed my desk, a bit dog-eared and reader-scarred. The article on cost control by Phil Carroll seems to hinge on one simple statement highlighted on page 69, "So Managers Will Have to Learn to Manage Better." The only thing I would suggest to change would be to underline the word *Learn*, for learning is the key word. Learning takes time and this time must be taken if we are to be better managers.

A. G. Dimond
Industrial Engineer
Ryan Aeronautical Co.
Torrance, Calif.

► Thanks for your comments on Phil Carroll's article on cost control. We agree—learning is the key. And too few managers take the time to learn. Incidentally, reprints of this article are still available at 50¢ a copy. Write to Reader Service Dept., FACTORY, 330 West 42nd St., New York 36.—ED.

SIMPLE SOLUTION

Sir:

In June 1959 FACTORY, page 150, there was an article "Rubber Stretches Ink-Pad Life." Could you furnish me with further details as to source of supply for the fine-ground sponge-rubber ink-pad?

Gerald Thomas
Purchasing Agent
Burlington Ribbon Mills
South Hill, Va.

► The Ryan Aeronautical Co. uses scrap sponge rubber from their upholstery shop and places this material in standard ink-pad containers. If you are not lucky enough to have scrap sponge rubber around your plant, we're sure you can obtain it from a local vendor.—ED.

Turn the page

B.F.Goodrich

News from your TIRE AND WHEEL TW ANALYSIS MAN

B. F. Goodrich All-Purpose tires speed operations for American Airlines

First to reach an American Airlines plane after landing —and last to leave before take off—is the tractor generator (above). It supplies power while the engines are stopped. Speeding the whole operation are B.F.Goodrich All-Purpose pneumatic tires. The new All-Purpose tread grips on all hauling surfaces, indoors and outdoors. Because it's pneumatic, the All-Purpose cushions the ride, protects load and floors, equipment and driver. If these are advantages you need and want in an industrial tire, the new All-Purpose may be your answer.

New pneumatic is "wired" for puncture protection

Here's money-saving news from B.F.Goodrich for every industrial tire user plagued with puncture problems and the resulting high tire costs and work delays. B.F.Goodrich pneumatic tires now come "wired" for puncture protection. Under the tread is a shield of steel wire mesh that protects the tire body from puncturing objects. Abrasive scrap materials are no longer the problem they once were. No more premature tire failures—no more costly delays.

You may have the kind of severe operating conditions that these B.F.Goodrich "wired" pneumatics are designed to override. To find out, mail the coupon below.

I can save you up to 50% on industrial tire costs

All-Purpose and "wired" tires are just 2 examples of the specialized industrial tires B.F.Goodrich makes. As your trained Tire and Wheel Analysis man, I know which tires are best for you. My survey of your operation costs nothing—can pay big dividends in money saved on tire costs. Mail the coupon today for my FREE services and tire recommendations.

Specify B.F.Goodrich tires when ordering new equipment.

The B.F.Goodrich Company
Department TW-786, Akron 18, Ohio

- ☐ Please send me information on All-Purpose tires.
- ☐ Please send me information on "wired" pneumatic tires.
- ☐ Please have my Tire and Wheel Analysis man call.

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

B.F.Goodrich *industrial tires*

For more facts Circle 455 on Reader Service Card

Another TENNANT First!

NEW walk-behind ELECTRIC SWEEPER!

NO FUMES, NO ODORS with the new TENNANT Model 40-E Electric Sweeper! Silent, safe and sanitary; assures an ULTRA-CLEAN sweeping job!

First of its kind, the new TENNANT Model 40-E *Electric* Sweeper is in a class by itself for ultra-clean sweeping and sanitary performance!

Compact. Just 33" wide, this new self-propelled, dual-battery machine is especially made for vacuumized sweeping of congested areas where standards of cleanliness are critical.

Economical. Replaces costly handwork. Sweeps more than 38,000 sq. ft. on a single battery charge under normal operating conditions.

Sanitary. Reduces air-borne dust . . . gets dirt that pushbrooms miss. And there are no fumes, no odors, no noise . . . *when you sweep electrically!*

WRITE TODAY *for illustrated bulletin.* G. H. TENNANT Co., 705K N. Lilac Drive, Minneapolis 22, Minnesota.

OUTSTANDING FEATURES

- Sweeps a 34" path (max.) on the run. Propels itself at 1.9 mph
- Saves manhours. Sweeps up to 2000 sq. ft. in 5 minutes or less
- Rotary 17" side brush sweeps flush with wall; 26" main brush "floats" to follow floor contours
- High volume vacuum; sucks fine dust into 2200 sq. in. filter area
- Dual front-wheel drive; 1 hp motor; 2 cu. ft. removable dirt hopper
- Easy-to-use, finger-tip control. Stops when handle is released
- Modestly priced to fit most budgets

TENNANT

Industry's Most Widely Used
POWER SWEEPERS

SPECIALIZED MAINTENANCE EQUIPMENT

FACTORY / LETTERS

Begins on page 8

SINCERE APOLOGIES

Sir:

A couple of errors crept into my article, "The Alcoholic: Who He Is, How You Can Help Him," in your June issue (page 244). In the first paragraph, the figure $8,750,000 should read $875,000—still a most substantial sum.

Also, the impression is given in the last paragraph on page 245 that "Manufacturing" might have a 31.4% *rate* of alcoholism. According to the latest authoritative figures, manufacturing does indeed carry the burden of about 31.4% of industrial alcoholism in the nation. The *rate*, however, is still only about 3% of the workforce. This represents some 600,000 alcoholics.

Arthur H. Cain
Director, Research Division
A. J. Ade & Co., Inc., New York 17

► We're red-faced and extremely sorry about the errors. In deriving figures from the author's basic data, we misplaced a decimal. Thus, the $8-million figure. And our wording *was* ambiguous in the percentage figures. We omitted three little words: "of the total."—ED.

ADDRESS WANTED

Sir:

We would like to order a copy of "The Businessman's Guide to Practical Politics" by J. J. Wuerthner, Jr., reviewed in April FACTORY (page 164). Can you give us the address of the publisher?

Vi Principe
Packard Bell Electronics
Los Angeles 64

► Address is: Henry Regnery Co., 64 E. Jackson St., Chicago.—ED.

MATERIAL HANDLING INFO

Sir:

We are in the process of evaluating maintenance and replacement policies covering our fleet of electric and gasoline industrial trucks. Could you send us some information on estimates as to the average economic life of these assets under normal wear and tear, and recommendations regarding the frequency

For more facts Circle 456 on Reader Service Card

For more facts Circle 457 on Reader Service Card ►

The Ludlow Line — Protection for Your Product with Paper

How Comet Snake Tape® saves you money in the shipping room

In the days of six-strip sealing, preparing packages for freight shipment was a slow and costly operation. Along came reinforced Comet Snake Tape and a happy change took place in the shipping room. Instead of using six strips per package — *two* strips of Snake Tape were used — *and with approval of all carriers.*

Sealing with Comet Snake Tape is ⅔ faster and more than twice as strong as six-strip sealing with conventional tape.

Snake Tape is typical of Ludlow's *job-tailored* packaging products. Look to Ludlow for greater protection, lower costs and faster packaging. We'll consider it a privilege to serve you!

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PAPERS, INC.

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Charlotte • Nashville • Chicago • St. Louis • Dallas
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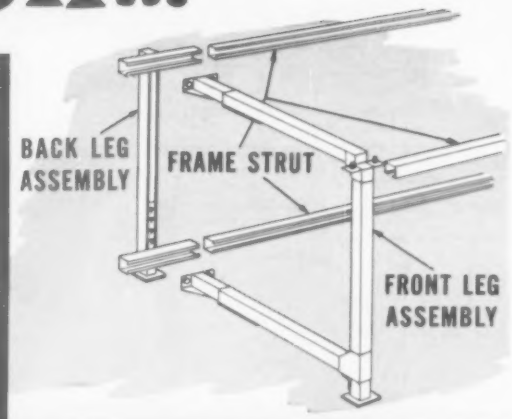
NOW...

with Standard Parts...



PRODUCT-A-FLOW Modular Work Stations

...become your Custom-Planned Layouts

Free your layout planning from conventional bench limitations. Develop the layout to solve *your* problems of space, time and motion economy... and set it up with standard Product-A-Flow catalog parts. It's easy! Three types of telescoping members frame any configuration and form many modular accessories. Other modular accessories include shelving, lighting, conveyors, circuitry, piping... and there are drawers, pocketbook holders, etc. All elements positioned where wanted.

Product-A-Flow layouts are readily modified or completely reassembled to meet changing requirements. Exchangeable liftout tops palletize your operation... simply move them with jigs and fixtures attached. You save your investment in benches over and over. Get full details. Send for bulletin 158.

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PRODUCTS FOR INDUSTRY

1530 Summer Street • Stamford, Connecticut

REPRESENTATIVES IN PRINCIPAL CITIES

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Send for
Bulletin 158

of various types of maintenance in order to assure peak efficiency, low-cost operation, and long economic life? We will appreciate any other information you can send.

Donald S. Adams
Materials Handling Engineer
The Champion Paper and Fibre Co.
Hamilton, Ohio

► Sorry, we haven't published comprehensive reports on your questions recently enough to be of value. But we can suggest two sources that should be helpful: The Material Handling Institute, 1 Gateway Center, Pittsburgh 30, and Material Handling Equipment Distributors Assn., Washington, D.C.—ED.

Sir:

We are seeking information on the operation of trackless trains so we can accurately estimate turning radii and aisle width requirements. Can you help us?

Phillip M. Fallon
Fairbanks Co., New York 3

► A reprint of the article, "Picking the Best Trackless Train for Your Plant" (FACTORY, January 1958, page 76), may not answer all your questions, but it will be of some help. And, you can probably get further details on the operational features of trackless trains from the Industrial Truck Assn., 1 Gateway Center, Pittsburgh 30.—ED.

MORE INFORMATION

Sir:

Referring to the article, "No Degreasing with New Lubricant," in FACTORY for June (page 149), we would like more information about the new method which eliminates degreasing in stampings.

J. Kizlauskas
Chief Engineer
Mele Mfg. Co., Inc., Utica, N. Y.

► Unfortunately, we have no additional information on this subject. However, we're sure Mr. N. J. Grover, Manager of Manufacturing, Westinghouse Electric Corp., Sturtevant Div., Hyde Park, Boston 36, will be happy to supply you with any added facts you require.—ED.

Short route or long, LINK-BELT trolley conveyors trim costs in

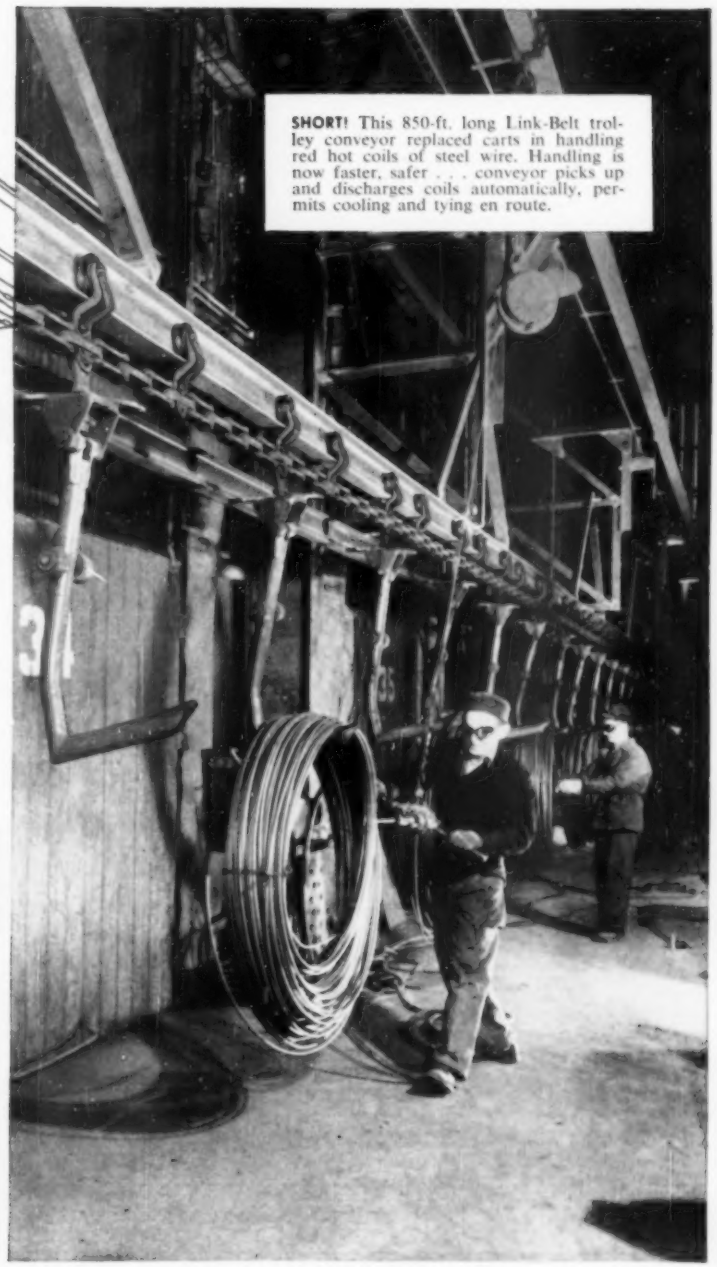
the move to modernization

Versatile systems conserve floor space, connect departments, coordinate processing

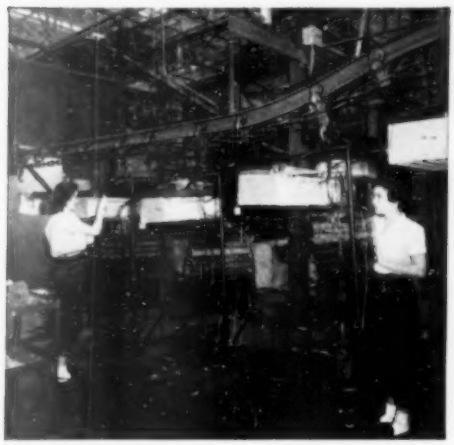
IN industry's move to modernization, Link-Belt trolley conveyors fulfill many basic objectives. In fact, few conveying methods affect production economics in so many ways, or so significantly.

They exploit otherwise unusable space, converting it to storage and traffic uses. They minimize manual work, prevent damage to the product. Resulting cost savings and production increases are seldom less than spectacular.

You can learn more about the versatility of Link-Belt trolley conveyors by contacting your nearest Link-Belt office. The experience gained from hundreds of installations will provide quick answers to any problems you have. Ask, too, for Book 2330 . . . containing trolley conveyor application and feature data.



SHORT! This 850-ft. long Link-Belt trolley conveyor replaced carts in handling red hot coils of steel wire. Handling is now faster, safer . . . conveyor picks up and discharges coils automatically, permits cooling and tying en route.

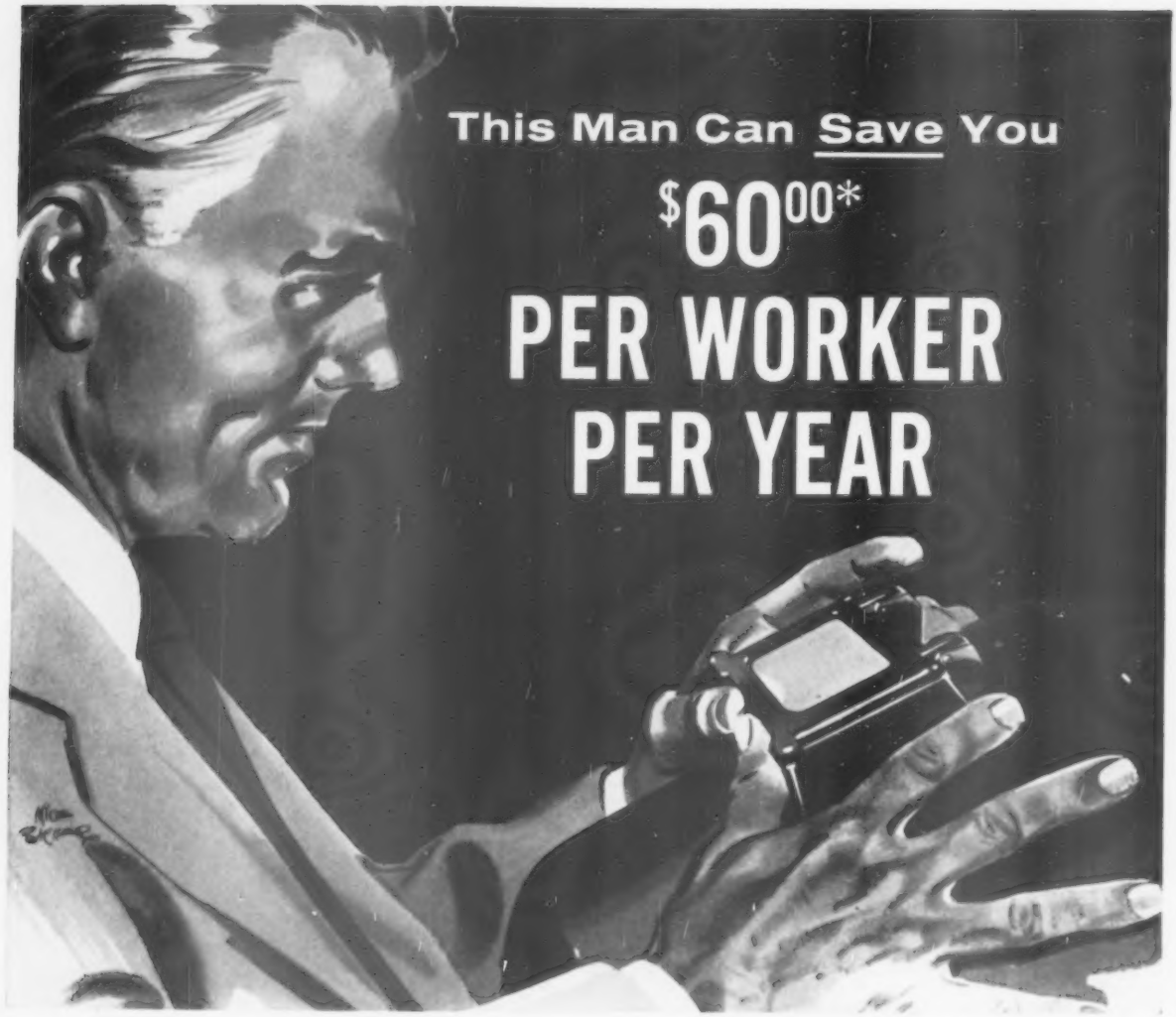


LONG! Twenty-one miles of Link-Belt trolley conveyors coordinate complex assembly operations at this appliance manufacturing plant. The integrated system prevents damage from excessive handling, conserves manpower for more productive work.

LINK-BELT

TROLLEY CONVEYORS

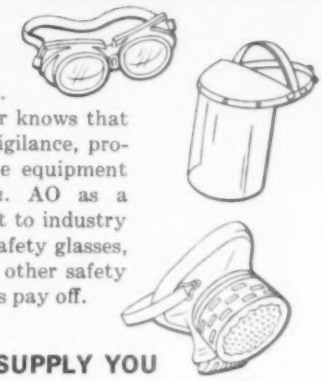
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15,128



HE'S A SAFETY DIRECTOR

Sometimes they call him "Safety Engineer", but whatever his title, never underestimate his power to keep costs down, production moving and morale high by preventing accidents. Anyone who can save $60. per worker per year is *important* — and belongs on the management team. In the area of eye accident prevention alone, there are men who have saved their companies over $100,000 annually. Add to this the savings in pain, grief and tragedy which can never be measured in dollars and cents.

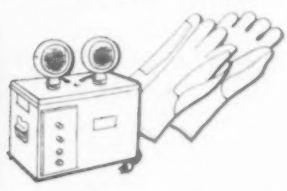
An experienced safety director knows that the price of safety is eternal vigilance, programs that work and protective equipment that delivers *without question*. AO as a major supplier of this equipment to industry provides the "tools" in quality safety glasses, respirators, gloves, clothing and other safety necessities to help these programs pay off.



YOUR NEAREST AO SAFETY PRODUCTS REPRESENTATIVE CAN SUPPLY YOU

Always insist on AO Trademarked Safety Products

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities



*Source: *Accident Facts*, National Safety Council

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For more facts Circle 461 on Reader Service Card ➤

Visualize color even brighter than this on fire protection equipment, obstructions, helmets, lift trucks, critical parts of machinery, containers, signs, etc.

REDUCE INDUSTRIAL ACCIDENTS WITH

New Day-Glo® Safety Paint

Industrial plants everywhere are reducing chances of costly accidents with new Switzer Day-Glo fluorescent safety paint. Day-Glo makes all indoor and outdoor safety hazards and safety markings actually glow as if lighted from within. Commands instant attention *especially* when visibility is poor. Makes the brightest ordinary safety colors (such as International Orange) seem dull by comparison. It's the same remarkable color now used by the U.S. Air Force and Navy to reduce mid-air collisions. Easy to apply with brush or spray. Evaluate Day-Glo in your plant now! Mail coupon today for free technical bulletin and color guide.

See Day-Glo at the National Safety Congress, Booth No. 305

Day-Glo is a registered trade-mark of Switzer Bros.

SWITZER BROTHERS, INC.
Industrial Finishes Division
4732 St. Clair Ave., Cleveland 3, Ohio

Please send me full details on Day-Glo Industrial Safety Paint.

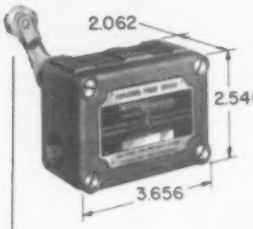
NAME _____ TITLE _____

COMPANY _____

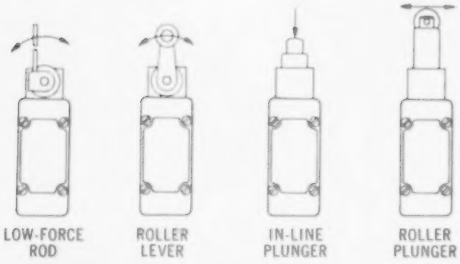
ADDRESS _____

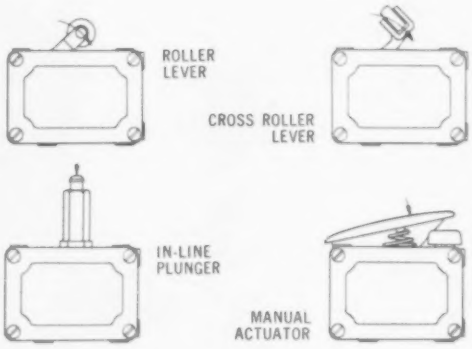
CITY _____ ZONE ____ STATE _____

"ML-E1" SERIES
Give excellent protection in most industrial locations. Available in 4 actuator designs. Rated at 20 amperes.

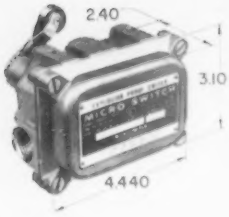


"EX" SERIES
Smallest explosion-proof switches available. Available in 4 actuator designs. Rated at 15 amperes.

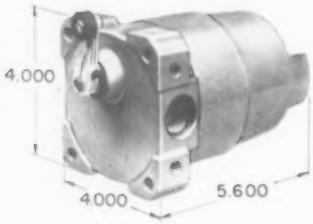




Dependable explosion-proof switches for use in hazardous plant locations



"EX1" SERIES
Two conduit openings—one at either end of the switch housing—permit through wiring, save cost and space.



"CX" SERIES
A weather-proof switch ruggedly housed to withstand outdoor conditions. Each of two SPDT switching units is operated by an opposite movement of the roller arm. Rated at 20 amperes.

These explosion-proof switches are ideal electrical controls in hazardous areas. They combine the ability to operate safely in explosive gas or vapor-air atmospheres with the desirable features of precise operation, accurate repeatability, small size, easy adjustment and durable construction. They are the most compact switches of this type available. All are Underwriters' Listed for Hazardous Locations Class I, Groups C and D; Class II, Groups E, F and G. (Send for Catalogs 83 and 84)

MICRO SWITCH explosion-proof switches are sold by distributors in key cities everywhere. See "Switches, Electric" in the Yellow Pages.

MICRO SWITCH . . . FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls Limited, Toronto 17, Ont.

Honeywell
MICRO SWITCH Precision Switches

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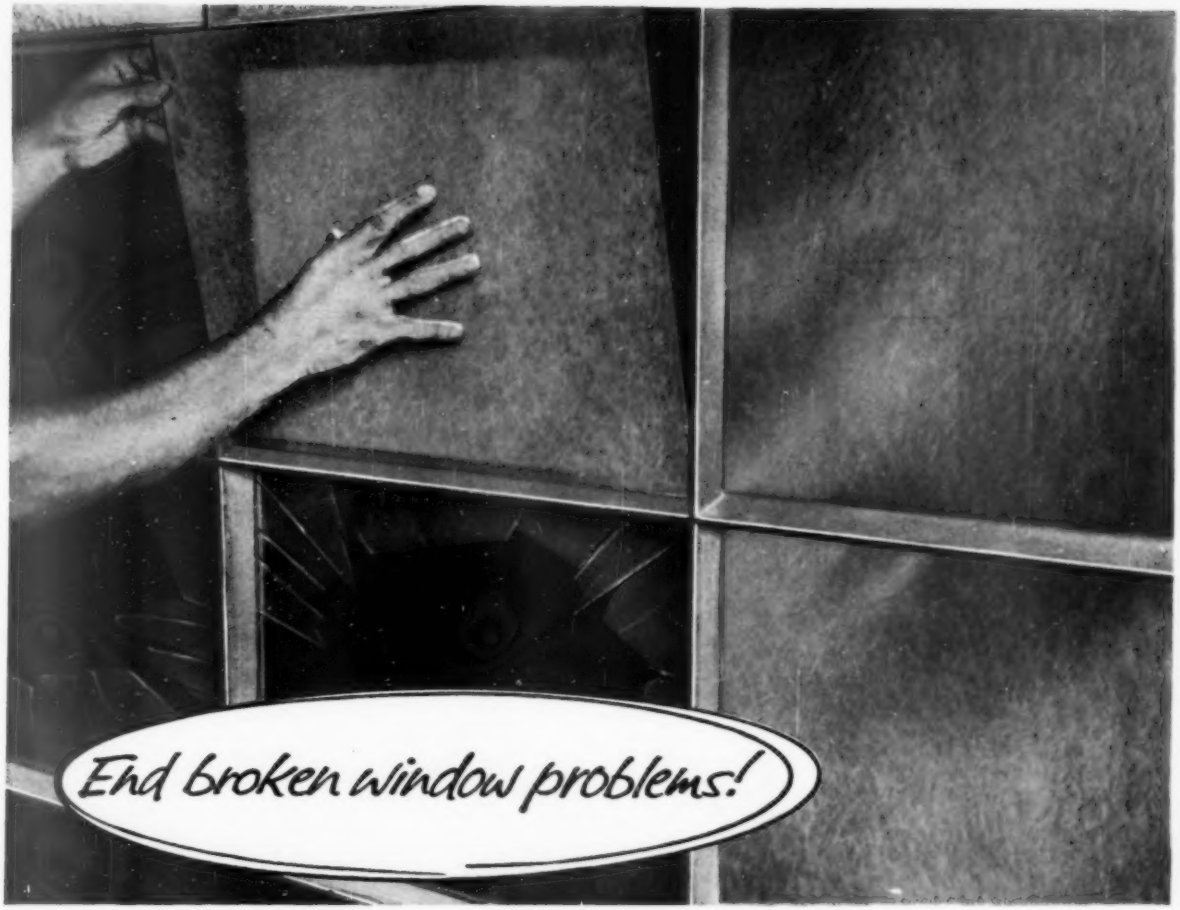


Reglaze for the last time with Johns-Manville Shatterproof *Corrulux*® Flat Panes

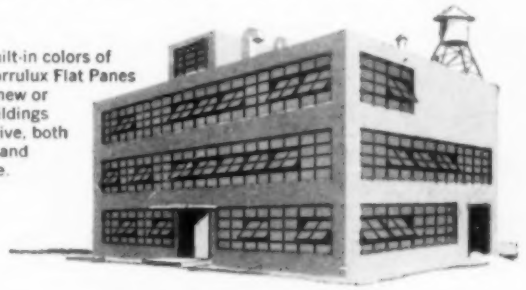
Johns-Manville shatterproof Corrulux Flat Panes are the logical and economical solution to the frequent, costly replacement of ordinary window panes.

Corrulux Flat Panes are composed of a superior, tough, weather-resistant plastic reinforced with thousands of high-strength glass fibers. They defy breakage associated with glass factory windows caused by vandalism, accidental damage and typical factory vibrations.

Being translucent, Corrulux Flat Panes admit and diffuse daylight, eliminate harsh glare and provide privacy. No need for blinds, shades or window painting. Corrulux Flat Panes come in pre-cut sizes to fit most window frames—or can be trimmed with a saw to any special size. They are available in smooth finish or granitized, in structural and heavy structural grades. Easy to install—no special glazing skill is needed. The hard surface of Corrulux resists the effects of most industrial fumes.

For complete details and samples, write to: Johns-Manville, Box 158, Dept. I, New York 16, N.Y. In Canada: Plastic and Allied Building Products, Ltd., Box 250, Dundas, Ont.

The built-in colors of J-M Corrulux Flat Panes make new or old buildings attractive, both inside and outside.



JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

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STOP.

For more facts Circle 464 on Reader Service Card

right here if you have a hand in plant paint purchases!

The handwriting's on the wall, in more ways than one, when it comes to modern plant maintenance. Today, more than ever, it is important that you find new ways to keep your material and labor costs in line! Which is why we're taking off the gloves to bring you some two-fisted facts on painting costs.

When you buy paint you pay twice . . . once when you purchase paint to do a job, *again* when you pay for labor to apply it. For this reason, it makes sense to specify a paint which not only looks good on your purchase order, but one that rings in with a new cost-cutting figure on maintenance crew time cards. And this is exactly what you buy when you specify Barreled Sunlight Engineered Paints. Each one is *engineered* to go on quick and easy to save man-hours . . . engineered to withstand the roughest, toughest conditions . . . engineered to hold its color, finish and "fresh-paint" look longer than any other paint you can buy.

We'd like an opportunity to prove this to you—in your own plant—without obligation. The famed Barreled Sunlight "On-the-Wall" Test is designed to demonstrate the kind of money-saving performance you *should* be getting for your paint dollars. It costs you nothing and *can* save you plenty. Fill out the coupon now.

Barreled Sunlight®

ENGINEERED *Paints*

FOR A BETTER LOOKING, LONGER LASTING PAINT JOB AT LOWER COST

BARRELED SUNLIGHT PAINT COMPANY
21 Dudley Street, Providence 1, Rhode Island

I have a hand in plant paint purchases . . . tell me more about Barreled Sunlight Engineered Paints!

☐ Please have your representative call me to arrange a free "On-the-Wall" Test.

☐ Please send me your new "Quick Reference Guide" to Barreled Sunlight Paints.

Name.....

Company.....

Street.....

City..... *State*.....

SAVE

Buy your power at lower cost. Bring it right to your large load areas at economical higher voltage. Save on the cost of your cable conductors. Then get the extra secondary unit substation advantages only I-T-E offers.

I-T-E saves you time. Because only I-T-E designs, fabricates and assembles complete unit substations in one plant. They are shipped all at one time and on one date, timed to mesh with your own construction schedule. So you save valuable construction time.

I-T-E saves you the risk of operating trouble. Transformer engineers and switchgear engineers coordinate their efforts to insure harmony of design. They work with manufacturing people to insure proper construction. They supervise final tests to insure proper performance.

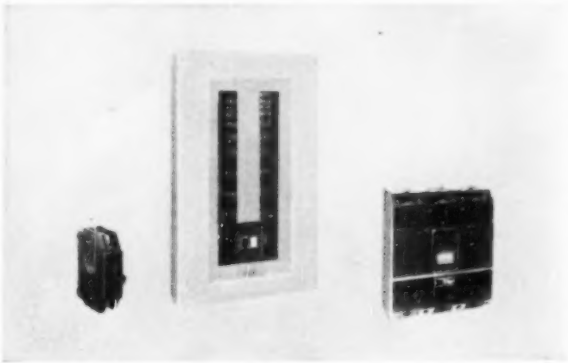
I-T-E saves you installation costs. I-T-E substations are completely assembled on the I-T-E floor before shipped. This insures that all holes line up. Hardware is provided. So when equipment reaches your plant, you are better protected against costly installation delays.

Forethought such as this goes into the design and manufacture of all I-T-E electrical equipment . . . the better to serve you. Good to remember when you get ready to buy.

FACTORY

New 100 amp Type ETI, EH frame, breaker. Here is a new addition to I-T-E's broad line of molded case circuit breakers. It brings economy and space saving for motor control center applications. Available in 2 and 3-pole construction. Type ETI, EH frame, breakers provide the ultimate in motor protection when used in conjunction with a motor-protective relay. The relay protects against overloads. The circuit breaker features pinpointed short circuit trip adjustment with external control previously available only on larger molded case breakers.

Space-saving d-c circuit breakers. A fault on most d-c lines involving large currents could really produce some spectacular results. But I-T-E Model FB d-c circuit breakers interrupt fault currents before they get into the danger area. Opening occurs in roughly 12 milliseconds. Rise rates of even 15 million amp per second are stopped sharp at 60,000 amp. This means extra protection for all associated equipment from damage that even momentary persistence of such high currents could produce. FB circuit breakers are available in either single or double pole. Only 10½ in. wide. Save space. Easy to install.



Preferred by equipment assemblers. Leading independent manufacturers recognize the superiority of I-T-E molded case breakers. And they buy I-T-E most of all. Experience consistently proves that I-T-E's better construction means more dependable performance. Ratings range from 15 to 800 amp continuous . . . the broadest scope of sizes and types in the field. Premium pole spacing eases installation and adds extra safety. Enclosed front-connected pressure terminals accept conductor sizes commensurate with breaker ampere ratings. Convenient externally adjustable instantaneous trip on larger size breakers permits easy, fast setting commensurate with short circuit requirements.

I-T-E Circuit Breaker Company I-3
1900 Hamilton St., Philadelphia 30, Pa.

- ☐ Secondary unit substations
- ☐ Power switching centers
- ☐ Molded case circuit breakers
- ☐ Metal-clad switchgear (4.16 and 13.8 kv)
- ☐ D-c circuit breakers
- ☐ TRANFO-UNITS
- ☐ TELEMAND* motor-operated molded case circuit breakers
- ☐ K-LINE circuit breakers
- ☐ Other_____

Name_____Title_____
Company_____
Street_____
City_____Zone_____State_____
*I-T-E Trademark

SEND COUPON OR WRITE
Get complete, up-to-date information on I-T-E equipment

I-T-E CIRCUIT BREAKER COMPANY

TYPE AGA
SERIES NO

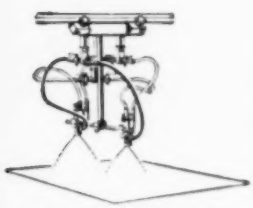
If you apply fluids anywhere in your process...

Consider DeVilbiss automatic spray...for control and uniformity not possible by any other method

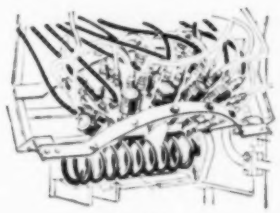
Whether you're finish-coating products of any size or shape . . . applying adhesives, lubricants, glazes . . . or marking, stenciling, surface treating . . . it's time you investigated the DeVilbiss automatic spray method for your process.

With DeVilbiss automatic spray guns, you eliminate coating variations common to other methods; material use is constant; production rates uniform; and costs substantially reduced.

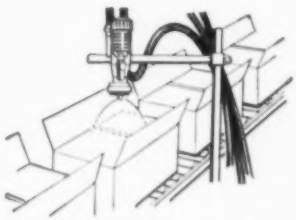
What's more, you can know in advance, without charge or obligation, the exact economies of automatic spray. We will simulate your operation in our fully equipped DeVilbiss research laboratory. Your supervisors are invited to be there. The results are passed along to you. Why not contact your nearest DeVilbiss representative, or write us in Toledo for all the facts.



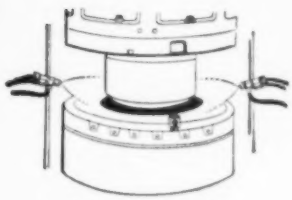
AUTOMATIC PAINTING



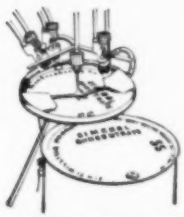
COLOR CODING



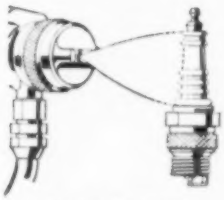
APPLYING ADHESIVES



LUBRICATING DIES



AUTOMATIC STENCILING



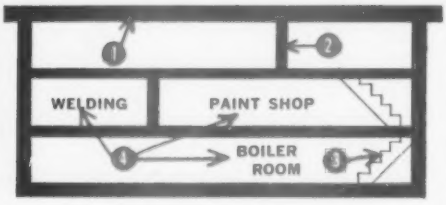
GLAZING CERAMICS

THE DEVILBISS COMPANY
TOLEDO 1, OHIO
Barrie, Ontario • London, England
São Paulo, Brazil
Branch Offices in Principal Cities

FOR BETTER SERVICE, BUY
DEVILBISS

OVENS • DUST COLLECTORS • INDUSTRIAL POWER WASHERS • FLOW & DIP COATERS • SPRAY BOOTHS
AIR COMPRESSORS • SPRAY EQUIPMENT • HOSE & CONNECTIONS • MIST-COOLANT UNITS

For more facts Circle 466 on Reader Service Card



WITHIN HOURS YOU CAN PAINT YOUR WAY TO FIRE SAFETY

1. Delay the collapse of beams by as much as 30 minutes.
2. Convert partitions into fire barriers instead of fire feeders.
3. Prevent fire from spreading up stairways and along corridors.
4. Eliminate the hazard from areas where fires are most likely to start.

95% of all fires start small—then spread swiftly over combustible surfaces . . . walls, doors, ceilings. Entire areas suddenly ignite. Steel beams can collapse five minutes after heat reaches them!

Not so with Albi Fire Retardant Paint—the quick, low cost way to give your buildings immediate fire protection. No chance of human or mechanical failure. Albi stops fire the moment it starts. Just apply Albi with brush or spray—no special experience required. Paint for maintenance, too—in one fast, single-coat application!

Albi's new, low Underwriters' Laboratories flamespread ratings assure fire protection never before possible. So follow the lead of industry and governmental agencies. Safeguard lives and property with a simple coat of paint —ALBI! The coupon below brings complete details.

ALBI MANUFACTURING CO., INC., Dept. FA-9, Rockville, Conn.

We would like to hear more about Albi's "Dual-Purpose" Fire Protection and Maintenance Program for our buildings. Send complete information.

☐ Please have your Fire Retardant Specialist call without obligation.

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... ZONE..... STATE.....

Albi

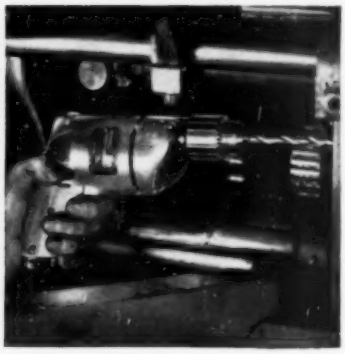
The Paint That STOPS FIRE!

For more facts Circle 467 on Reader Service Card

For more facts Circle 468 on Reader Service Card ➤

62% More Power . . . 8.5% Lower Price

MOST POWERFUL DRILL of its size available, the ¾" Standard. Powered to pull a locomotive with full power in reverse; positive drive chuck.



TREMENDOUS TORQUE developed by this ½" H.D. Holgun® takes on the tough ones with ease. Compact to work in tight quarters, this tool's a "best buy."

DRILLS UPSIDE DOWN! B&D Magnetic Drill Presses stick like glue in any position; operate manually or with exclusive remote control. 1¼" or ¾" capacities.

POWER NEARLY DOUBLED in B&D ¼", ⅜" and ½" End Handle Drills gives you more performance per dollar. Shown: ¼" Heavy-Duty—for production use.

Now, new value throughout Black & Decker Drill Line

Black & Decker's done it again! An entirely new concept in drill power plus new streamlining result, for example, in a ½" Special Drill with twice the power output per pound—that is 20% lighter. And, you can buy it for even less than ever before.

And value like that extends throughout the B&D drill line . . . new motors, new compactness, new streamlining, new features like full-power in reverse at no extra cost. Result? More value than ever before in the world's most preferred drill line. In fact, you now get up to twice the value per dollar! Write today for a free demonstration.

YOU GET A Better Value FROM **Black & Decker®**

Quality Electric Tools

MAIL COUPON FOR FREE DEMONSTRATION

THE BLACK & DECKER MFG. CO.
Dept. 0709, Towson 4, Md.

Look Under "TOOLS-ELECTRIC" in Yellow Pages

☐ Please arrange for a demonstration of the following drill(s) .....

☐ Please send me additional information on .....

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

☐ Impact Wrenches

☐ Hammers

☐ Belt Sanders

☐ Vacuum Cleaners

"Here at HONEYWELL we're control men

Honeywell
H First in Control

"We have a basic philosophy here at MINNEAPOLIS-HONEYWELL. As control specialists, we've learned that it is our *specialist's approach* to design, installation and service that enables our controls and instruments to do their best in operation.

"We feel the same way about elevators. We have 4 OTIS Passenger Elevators and 6 OTIS Freight Elevators in our Minneapolis plants. We know that they'd end up as strangely *mixed breeds* if we attempted their maintenance — because a careful study of the OTIS *specialist's approach* to maintenance has convinced us that only OTIS can keep our elevators running like new."

What is the OTIS *specialist's approach* to elevator maintenance? It is MEN . . . MATERIALS . . . METHODS.

MEN: Elevator maintenance is no one-man job. It is an organization task requiring experts in many lines. No individual, even if he devoted his entire time to the job, could do it properly. It calls for men with an unusual combination of skills plus long OTIS training in studying parts, assemblies, functions, replacement procedures, testing and adjusting. Some degree of elevator complexity can be gleaned from the illustration at the right.

MATERIALS: Original OTIS parts and specially designed OTIS maintenance equipment are within one hour of 90% of all OTIS elevators in the U. S. for use in scheduled replacements—and to hold emergency shutdowns to a minimum.

METHODS: With more than 40,000 elevators under OTIS maintenance, OTIS has developed an actuarial procedure that replaces wearing parts well in advance of their breakdown point to hold shutdown to an absolute minimum and assure the highest possible safety.

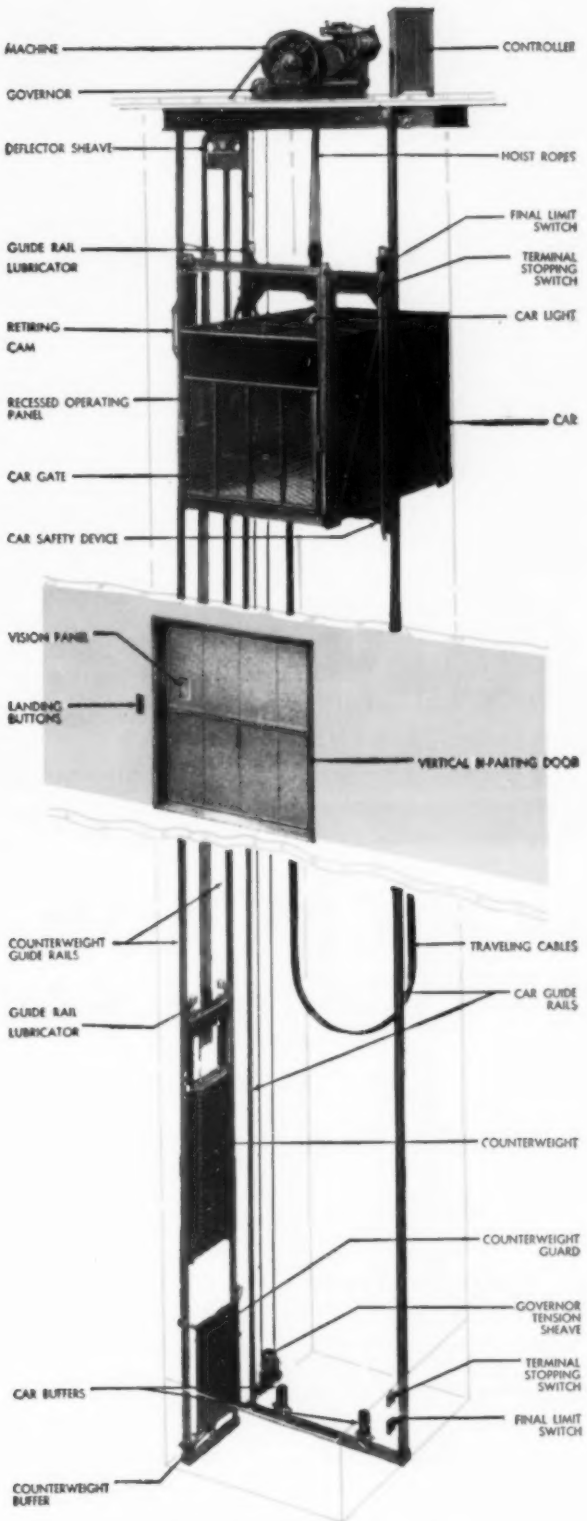
elevator maintenance

THAT KEEPS ELEVATORS RUNNING LIKE NEW

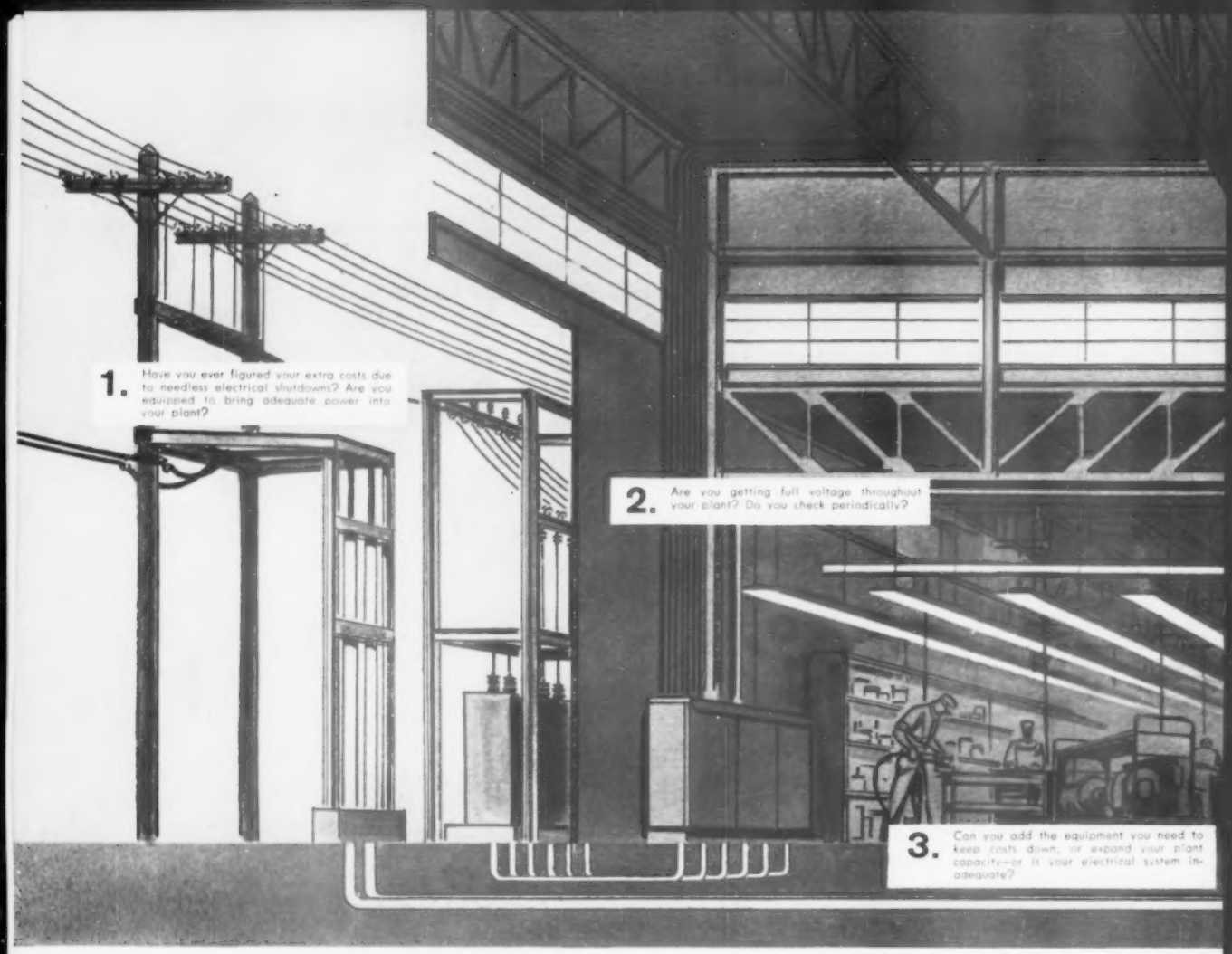
OTIS ELEVATOR COMPANY • 260 ELEVENTH AVENUE • NEW YORK 1, N.Y.
OFFICES IN 297 CITIES ACROSS THE UNITED STATES AND CANADA

FACTORY

. . . not elevator maintenance men"



For more facts Circle 469 on Reader Service Card


1. Have you ever figured your extra costs due to needless electrical shutdowns? Are you equipped to bring adequate power into your plant?
2. Are you getting full voltage throughout your plant? Do you check periodically?
3. Can you add the equipment you need to keep costs down, or expand your plant capacity—or is your electrical system inadequate?

HOW MUCH CAN A HIGH-VOLTAGE CABLE SYSTEM SAVE YOU?

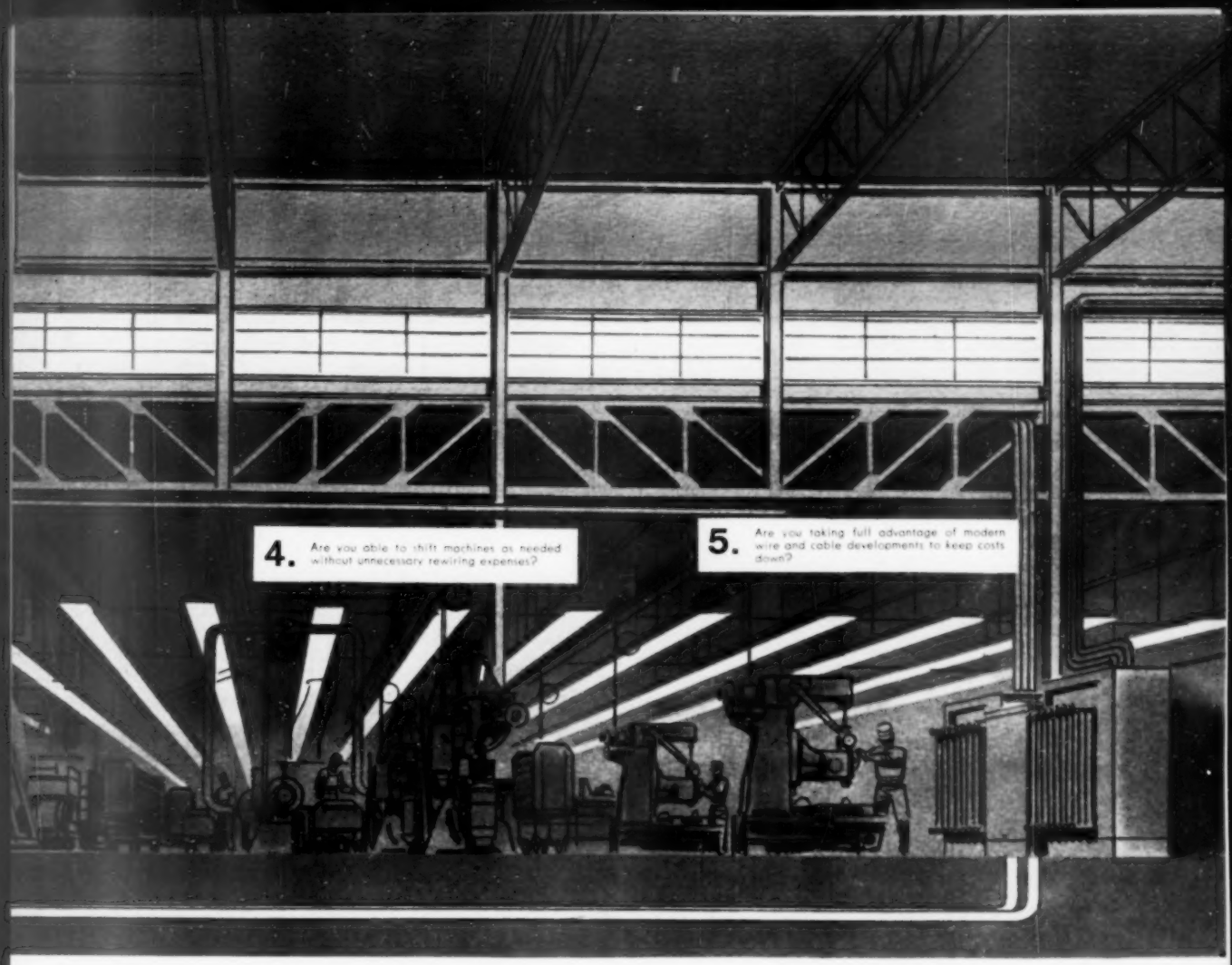
These 5 questions may lead you to some important cost reductions. And Anaconda technical specialists are available to help you get the answers.

1. Have you ever figured your extra costs due to needless electrical shutdowns?

These extra costs can be: lost production time, cost of labor standing by while repairs are made, damage to goods in process, loss of business due to delayed delivery, cost of repairs themselves. Such shutdowns can be caused by overloaded circuits, poor quality or overaged cable, or inadequate protection against nonelectrical hazards such as chemical fumes, atmospheric conditions, mechanical damage. Your electrical department, your electrical contractor or the Man from Anaconda can help you avoid these costly shutdowns by recommending proper cable for your present or future electrical system.

2. Are you getting full voltage throughout your plant? Do you check periodically?

Low-voltage conditions in your plant can bring about reduced production, excess current consumption, failures of motors from overloading. It can even prevent the use of all your machines at the same time. That's why it is important to bring power into your plant at sufficiently high voltage to service present *and* anticipated


4. Are you able to shift machines as needed without unnecessary rewiring expenses?
5. Are you taking full advantage of modern wire and cable developments to keep costs down?

requirements. Dependable cable, of course, is of the utmost importance – the cable produced by Anaconda and discussed on the following two pages.

3. Can you add the equipment you need to keep costs down, or expand your plant capacity —or is your electrical system inadequate?

Inadequate cable capacity in your plant results in *excessive* power loss caused by increased voltage drop. Not only are you paying for *wasted* power, but your electrical system is incapable of handling modern cost-saving equipment. *Efficiency* is down and so are profits.

4. Are you able to shift machines as needed without unnecessary rewiring expenses?

Plant inflexibility can strangle both growth and efficient operation. Plants wired in rigid conduit, for example, often make the shifting of machinery slow and expensive. Cables such as Anaconda butyl-insulated Duralox,* with its *built-in* interlocked armor, and flexible Anaconda Powerduct Cable eliminate such expensive rewiring when equipment must be moved – save you time, money, labor and permit cost-saving freedom in the arrangement of your machinery. You'll find further details about them on the following pages.

5. Are you taking full advantage of modern wire and cable developments to keep costs down?

Thorough inspection of your plant's electrical system, talks with your electrical engineers, qualified electrical contractors or the Man from Anaconda can show you where you are needlessly losing money. Once you discover these profit-robbing problems, Anaconda stands ready to help you do away with them – with an outstanding range of quality wires and cables for every electrical need . . . to permit you to concentrate on production with the assurance that your electrical system is the most efficient, most economical possible.

*Reg. U.S. Pat. Off.

Please turn page for more information.

ANACONDA WIRE & CABLE COMPANY
25 Broadway, New York 4, N. Y.

HOW MANAGEMENT CAN REDUCE HIDDEN ELECTRICAL COSTS WITH ANACONDA BUTYL-INSULATED, "PRECISION-BUILT" HIGH-VOLTAGE CABLE.

Management in the past has left electrical problems to electrical people—but has not always provided them enough money to do an adequate job. Result: poor performance... high costs!

A little goes a long way—especially when it's the *little extra* invested in your electrical system which will save you costs of cable failures, machine shutdowns, high maintenance, lost production.

The previous page has indicated why management should take an active interest in electrical systems . . . it has *shown how* and *where* inadequate wiring eats into your profits. Now, without being technical, let's look at *what* can be done about it . . . how new Anaconda products can make a significant contribution to your profit picture.

THE WORLD OF MODERN WIRING has made outstanding advances—and within the last few years. Here are some of the more important ones. Read them over *in light of changes that have probably taken place in your plant since the original wiring was installed.*

NEW HIGHER VOLTAGES. Many electrical problems in plants today can be traced to low-voltage conditions. That's why higher plant voltages—with resulting increased efficiency—deserve primary consideration. A few years ago, high voltages posed a problem: ozone, a by-product of high-voltage operation, destroyed ordinary insulation, causing premature cable failure. Anaconda engineers have solved this problem with pioneering work in new *butyl-rubber* insulations. (See below.) There is a high-voltage Anaconda cable to fit every plant need: corrosion-resistant Durasheath,* Duralox Interlocked Cable that needs no conduit, and easily installed weather-resistant Anaconda Aerial Cable.

*Reg. U.S. Pat. Off.

TESTS . . . SERVICE RECORDS—THEY ALL PROVE

Anaconda Butyl (AB) Rubber Insulated High-Voltage Cable gives you more amps per dollar

Anaconda Butyl (AB) insulation gives performance far beyond industry specification standards — in *every* important electrical and physical property. Butyl rubber has inherent high resistance to ozone, heat and moisture. Thus, compounding efforts ordinarily spent to obtain these qualities have been devoted to the development of other desirable properties . . . giving you a cable with *quality throughout.*

To provide added assurance of peak performance, Anaconda manufactures its butyl-insulated high-voltage cable under controlled conditions on the most modern equipment, subjects it to rigorous tests. These tests have proved conclusively Anaconda Butyl (AB) has greater resistance to ozone than any other known rubber insulation. The real proof, however, is the service records of the millions of feet of Anaconda butyl-insulated high-voltage cables giving years of dependable superior service to utilities and industrials.

This advertisement can, of course, provide only a few examples of how modern Anaconda wires and cables are helping industry achieve more efficient production . . . reach full power for full profit. Your own electrical department, your qualified electrical contractor, consulting engineer or the Man from Anaconda can give you personal and expert assistance with the wiring needs of your plant.

59238

ANACONDA® WIRE &

25 BROADWAY,

FACTORY

NEW CABLE HAZARDS. Chemicals, moisture, oils – natural to most modern plants – are tough on cable. Engineers at Anaconda have come up with an answer: Durasheath, made with Anaconda Butyl (AB) insulation and specially compounded neoprene jacket – a superior product for low and high voltages. This rugged cable resists almost every enemy of cable life. And it is versatile. You can use it throughout your plant – aerially, in ducts, buried directly in the ground. It reduces down-time, maintenance and replacement costs. In addition to Durasheath, Anaconda offers the following cables with the same outstanding resistance qualities: Duralox Interlocked Cable, Aerial Cable, Densheath 900 industrial wire, all-purpose 20-10 thermoplastic control cable.

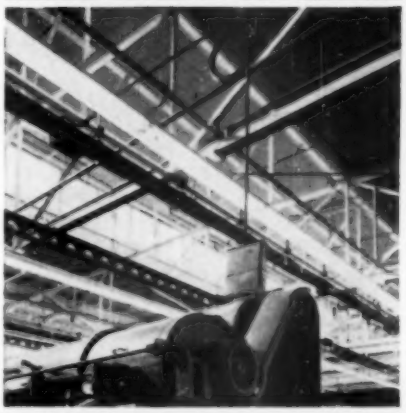
NEW OPERATING CONDITIONS. These have put new demands upon wiring. Higher loads generate more heat in cable . . . and more heat in cable, whether installed underground or in other moist locations, can destroy cable insulation. Today, Anaconda Butyl (AB) rubber insulation, used on many Anaconda rubber power cables, does the job withstanding *heat* and *moisture* at higher operating temperatures.

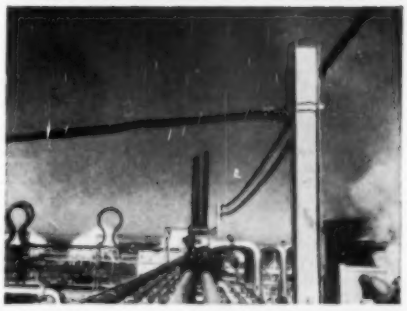
NEW EQUIPMENT. The introduction into plants of process-heating equipment, process or comfort air conditioning, and new production machines calls for new wiring to carry the increased load. Anaconda Interlocked-Armor Cable can be installed up to 40% quicker than many other types of cable because it needs no conduit. You save time and money when the cable is installed – and later, too, if cable must be moved. This cable is 100% salvageable, it reduces fire hazard . . . can be taken down and used again when plant changes are required.

MODERN BUSWAY SYSTEMS. Anaconda's flexible Powerduct Cable now makes it possible to increase the flexibility of your busways as never before. It just plugs into the busduct . . . and unplugs when you want to move machines. No costly conduit to put up or rip out. You effect important savings in production time and in labor. In addition, Anaconda Powerduct Cable is also 100% salvageable on every move!

NEW POWER. As modern plants find the need of bringing more and more power into their working areas, more and more are choosing Anaconda Aerial Cable. It's a wise, economical choice – especially where the underground area is congested with pipes and other structures, or contains corrosive agents. Anaconda Aerial Cable is easy to install – even between closely spaced buildings where clearance is limited. Anaconda Aerial Cable is neat, safe, reliable, lower in cost than underground systems.

NEW ELECTRICAL EQUIPMENT. The trend to automation and more complex machines puts new emphasis on control cable. Here, again, Anaconda's years of cable experience has paid off in a full and constantly growing line of superior control cables – with modern types of insulations and coverings to give them highest reliability. The most promising control cable development is the all-purpose 20-10 thermoplastic design for 600 volt service (30-15 control cable for 1000 volt service). Anaconda Control Cables – both in rubber and plastic – assure you the most reliable service.



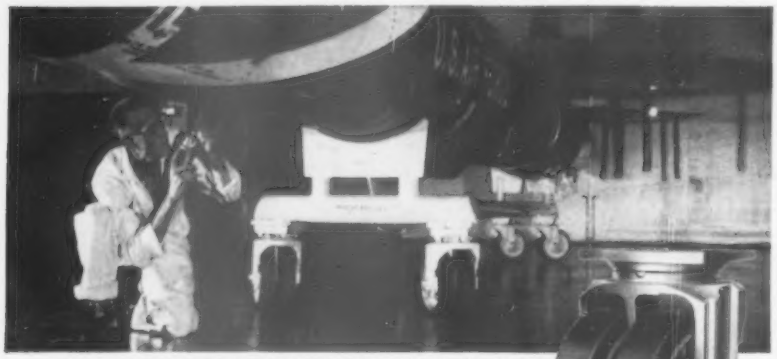


CABLE COMPANY

New York 4, New York

MATERIALS-HANDLING NEWS

NEW AND UNUSUAL APPLICATIONS OF BASSICK CASTERS THAT MIGHT BE ADAPTED TO YOUR HANDLING PROBLEMS



Bassick heavy-duty double-wheel caster with "Floating Hub."

Rolling Ground Support For Air Force BOMARC

The U. S. Air Force "Bomarc" interceptor guided missile made by Boeing Airplane Company, Seattle, Washington, will fly far and fast to guard the U. S. from attack by enemy aircraft.

But in base assembly areas and maintenance shops, as shown here, Bomarc rolls on heavy-duty Bassick double-wheel "Floating Hub" casters. Double wheels give high load capacity and resistance to tipping. The unique Bassick "Floating Hub" absorbs shocks, damps vibration, and eliminates shimmy and bouncing.

Bassick's "Floating Hubs" are the only spring-mounted casters that can effectively absorb horizontal impacts. "Floating Hub" casters are available in a complete line, from light-duty single-wheel types to the heavy-duty type shown here. They're ideal for power-pulled applications, and they keep on rolling under conditions that ruin ordinary casters.

New Rubber-Tired Steel-Side-Plate Wheels

Bassick casters are available with bolted-steel-disc wheels with demountable tires in 3½-, 4-, 5-, 6-, and 8-inch sizes. They're recommended for any institutional or industrial application within the load capacity of the tire.

Look at these big features: • *Floor protection*—highest quality rubber tires • *Replaceable tires* • *Strong, easy rolling*—permanently adjusted bearings • *Neoprene or conductive tires*—available when specified.

Unique "Dolly Train" Rolls On Bassick Casters

At Convair Division, General Dynamics Corporation, Fort Worth, Texas, this power-pulled, 160-dolly train features Bassick casters.

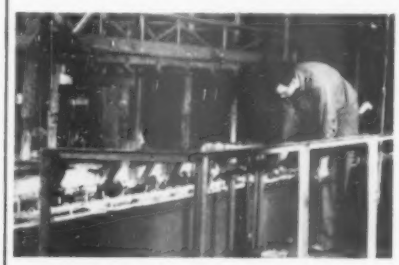
Bassick casters go a long way to insure the dollies' continued efficiency under severe power-pulled service. Ask your Bassick distributor for details on Bassick casters for power pulled dollies and "live skids."

New Automatic Rustproofing for Bassick Casters

Rustproof zinc plating is an added-quality feature of Bassick formed-steel truck casters.

Now, this new $90,000 completely automatic zinc-plating machine at Bassick's Bridgeport plant puts a better, more uniform zinc plate than ever on vital metal caster parts.

Loading and unloading Bassick's new automatic zinc plating machine. Girl on right loads caster parts for trip through machine. Shiny parts on left have already been plated.



Plating tanks of new automatic zinc plating machine. "Standard Salt Spray Test" proves that zinc plate produced by machine is far better than that required by Federal Specifications.

For information on casters... ask your local distributor

There is a Bassick Caster Distributor near you. He's qualified to recommend the right caster for your job. He sees a lot of materials-handling systems and you'll benefit by his knowledge of a wide variety of industrial plants. 9.38

THE BASSICK COMPANY
BRIDGEPORT 5, CONN.
IN CANADA:
BELLEVILLE, ONT.

Symbol of SW Excellence
Bassick
A DIVISION OF
STEWART-WARNER CORPORATION

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For more facts Circle 472 on Reader Service Card ➤

IT'S
A MATTER
OF
pulling
together!
GOODYEAR
Pulling together pays off more than ever before when you use the new "Plus-Rated" V-Belts with the Green Seal by Goodyear. See for yourself—

Year after year–at plant after

Goodyear V-Belts with

the toughest jobs–at the lowest cost

–IN AN ILLINOIS GARAGE EQUIPMENT PLANT

Operation: Finishing surfaces of cylinders used on automobile lifts

Drive: Oily main drive of heavy-duty cylindrical grinder

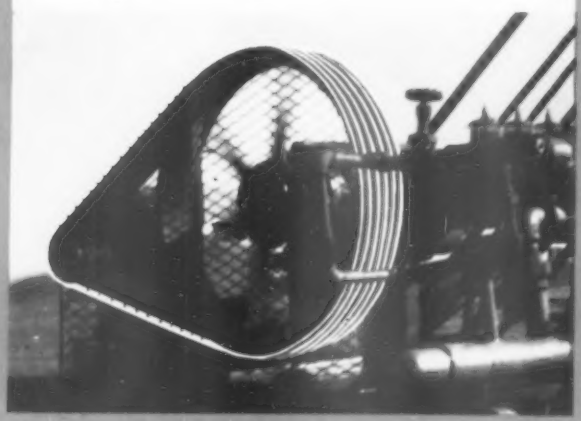
Service: Set of 5 matched oil-resistant V-Belts with the Green Seal pulled together to give user 6 times the service of previous belts

–ON TEXAS WATERFLOODING PUMPS

Operation: Pressure-pumping salt water into "tired" oil wells to reactivate them

Drive: 15 h.p. pump drive that feeds salt water into wells under 600-900 psi pressure

Service: Five-belt set of V-Belts with the Green Seal pulled together, eliminating slippage problem caused by previous belts and averaging 2 years' service where others had failed in 6 months



–and now they're "Plus-Rated" for greater

lant–on drive after drive–

he Green Seal handle

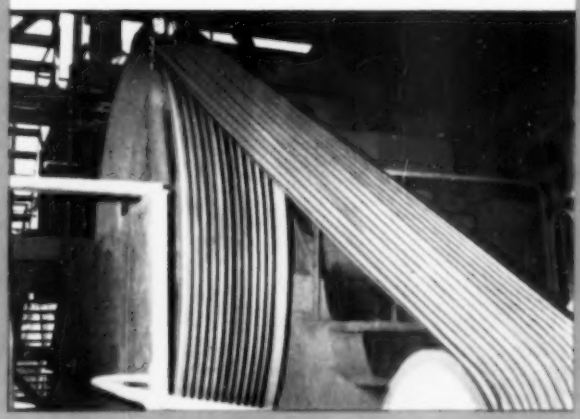
–over the longest trouble-free life–

–AT AN OREGON LUMBER MILL

Operation: Debarking giant logs
Drive: 25 h.p. 900-1800 r.p.m., 2-speed main drive on barker
Service: Matched V-Belts with the Green Seal–five to the set–pulled together and outlasted previous belts 14 to 1–eliminating down time–saving $40 a month to boot

–ON A PENNSYLVANIA ROCK CRUSHER

Operation: Crushing dolomitic limestone
Drive: Main drive on bulldog-type rock crusher
Service: Set of 14 matched V-Belts with Green Seal construction pulled together to crush 600,000 tons of limestone a year for 14 straight years–was still going strong at last report



horsepower-transmission per dollar!

HERE'S THE STORY

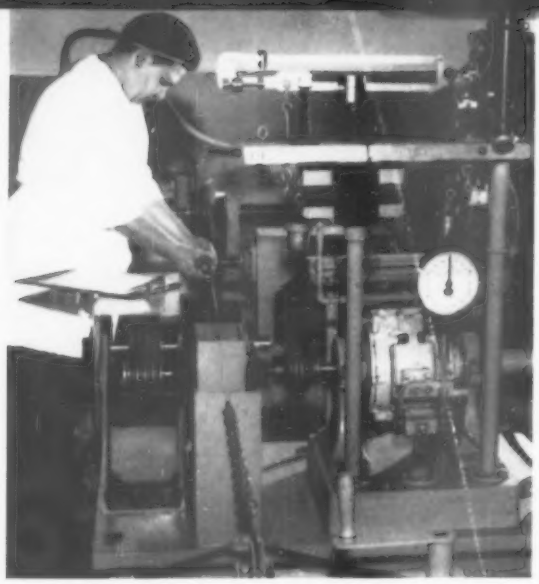
New

"Plus-Rated" V-Belts

with the

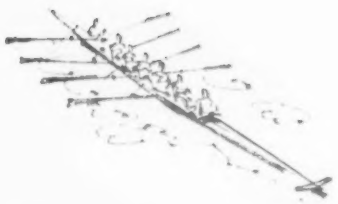
Green + Seal

give you all these "pluses"



- Bonus horsepower ratings at no extra cost
- Maximum horsepower hours per dollar of any belt you can buy
- Matched V-Belt sets that *stay* matched in storage—on the drive
- Unequaled stretch-resistance—thanks to high-modulus construction with load-carriers of airplane-type steel cable or 3-T cord
- Smooth-running uninterrupted performance with specially compounded non-dusting rubber covers that never stick in the grooves
- Maximum resistance to shock-loads—guaranteed by breaking-point tests that exceed the strain of severest service

—Add up all these plus features and you'll see why the new "Plus-Rated" V-Belts with the Green Seal are your best belt buy for longer-than-ever, more-trouble-free service at lower-than-ever cost. For details, contact your Goodyear Distributor—or clip, fill in, and mail the coupon below.



Green Seal—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

"PLUS-RATED" V-BELTS WITH THE GREEN SEAL BY

GOODYEAR

THE GREATEST NAME IN RUBBER

S-51165-K

THE GOODYEAR TIRE & RUBBER COMPANY, Industrial Products Division, Dept. 794, Akron 16, Ohio
Please send me more information on the great new "PLUS-RATED" V-Belts with the Green Seal.

Name _____

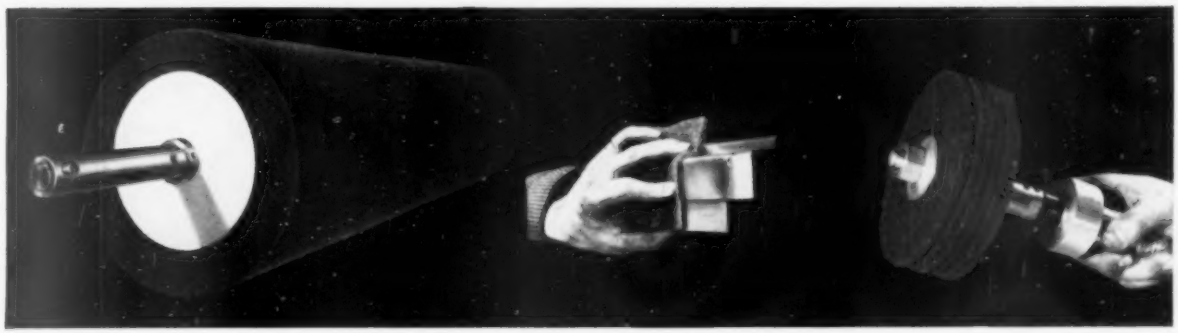
Company _____

Street Address _____ City _____ Zone _____ State _____

3M Announces... **NEW**...the miracle production cleaning material...

SCOTCH-BRITE®

Cleans better, cleans faster, costs less!



We'll prove it on your toughest cleaning jobs!

What do you have to clean?—raw stock, product parts, production equipment? We've tested and proved "SCOTCH-BRITE" Brand Cleaning Material for them all—for example, conveyors, tanks, bins, and vats, on flat metal, tubing, glass molds, printing plates, printed circuits, on metal/plastic combinations and many others.

You've never seen anything like new "SCOTCH-BRITE" material: a tough, springy, web-like pad of nylon filament with small working particles of abrasive mineral. Lightweight, long-wearing, easy to bend, fold or cut to shape. Let us show you how easily "SCOTCH-BRITE" loadings can replace your present power brushes, on almost any fixed or portable hand or automatic cleaning equipment!

We'll prove it with your present equipment!

See for yourself how "SCOTCH-BRITE" Brand Cleaning Material outcleans and outlasts wire brushes, fiber brushes, steel or other wools—and at lower initial cost, too! It wipes away dirt, grease, wax, stains, scale or oxides; follows complex contours that bristles can't reach—and rinses clean without rusting or staining!

We'll prove it—at no obligation to you!

MINNESOTA MINING AND MANUFACTURING COMPANY
3M COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW

3M Co., 900 Bush Ave.,
St. Paul 6, Minn., Dept. ABP-99

Please call to arrange a free demonstration of "SCOTCH-BRITE" material on our cleaning operations.

NAME_____

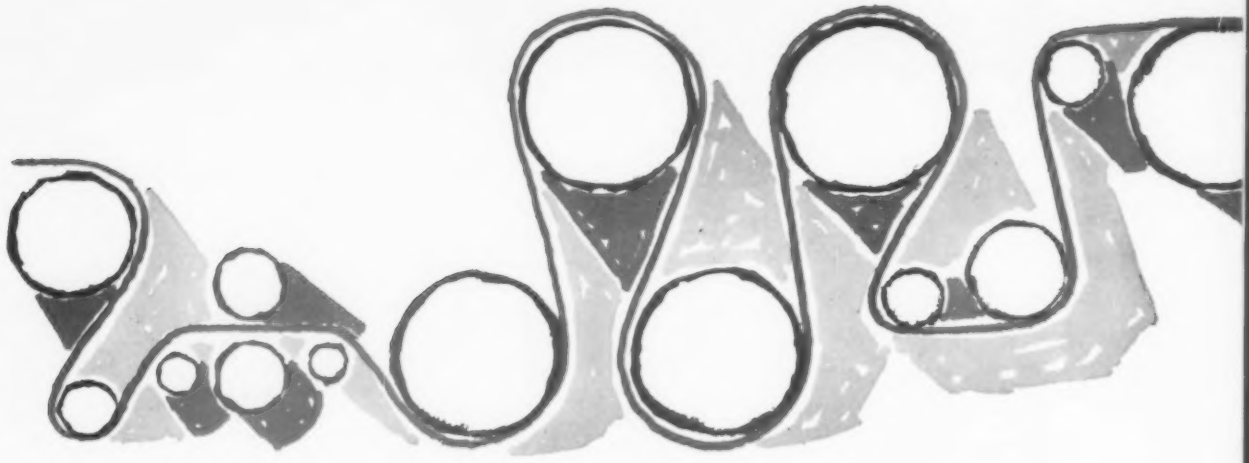
POSITION_____

COMPANY_____

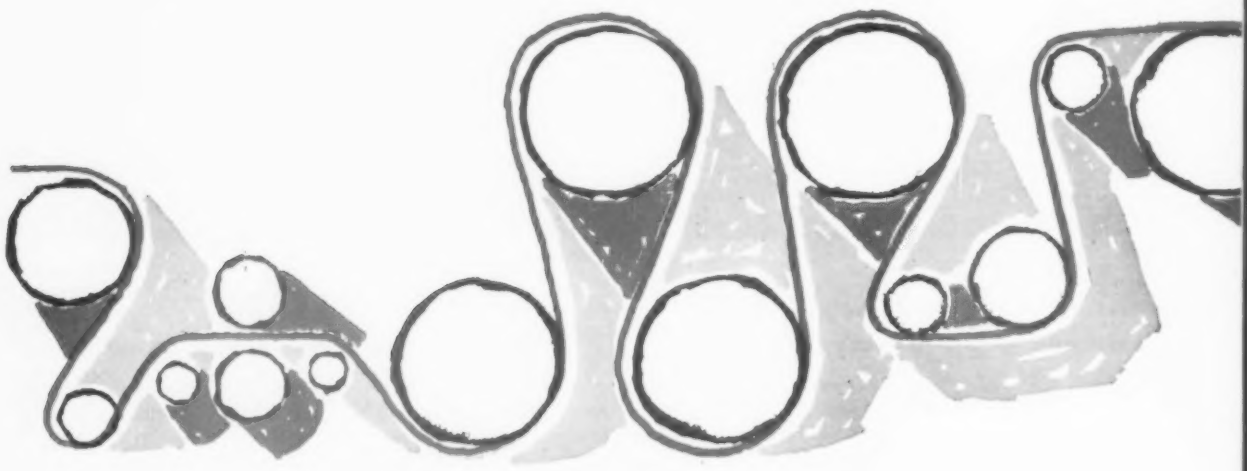
ADDRESS_____

CITY_____ ZONE___ STATE_____

The term "SCOTCH-BRITE" is a registered trademark of 3M Co., St. Paul 6, Minn. Export: 99 Park Ave., New York 16. Canada: London, Ontario



Before Crown-Zellerbach Powered-Up at Port



Now, greater use of electric power helps

POWER-UP FOR PROFIT

Townsend, one machine produced this much paper

increase machine capacity, reduces unit costs

ELECTRICALLY

Power-Up is a Westinghouse program to help you increase profits through greater productivity. In your plant it may be higher capacity machinery or an engineered drive system to provide increased speed and range flexibility from existing equipment. Whatever your need, maximum use of low-cost kilowatthours can help you earn satisfactory profits. You will need more capacity to meet the 40% increase in demand for goods by 1965.

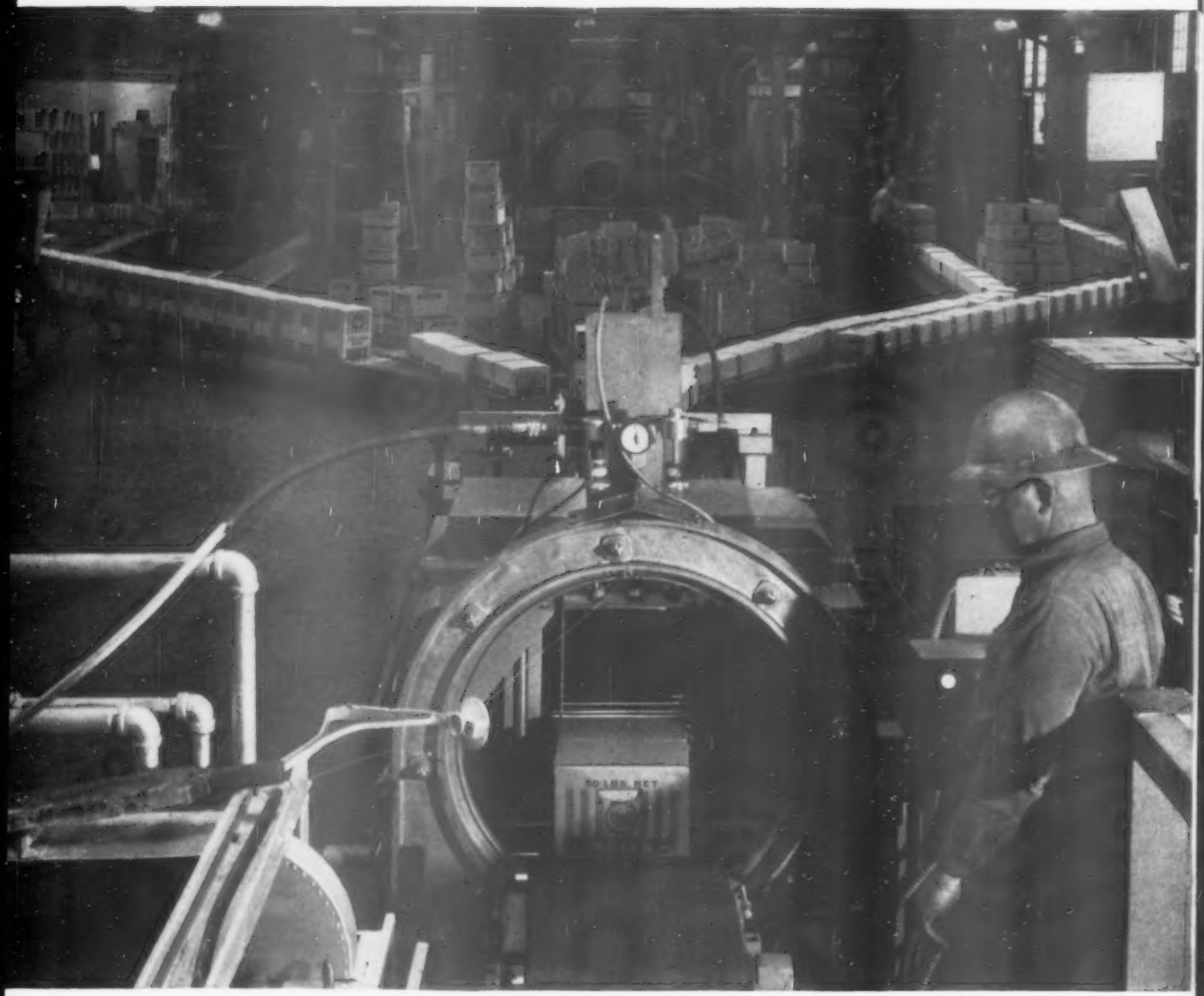
Be sure—like Crown-Zellerbach—that your electrical equipment is engineered to produce profits as well as output. Call your Westinghouse representative or your electric utility power sales engineer. They can tell you the electrical steps you can take now to start a Power-Up program in your plant. J-96137

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

Another example of USS **COMPLETE**

Model 12 does the work of two machines



Lightens your work—In the packaging operation shown here, one Model 12 USS Strapping Machine replaced two machines which were formerly needed to handle a wide variety of box sizes. The manufacturer reports, "Adjusting the strapping machine for different-sized cartons is now a matter of two or three seconds versus two or three minutes to adjust the previous machines. Where the old system was capable of binding 2,400 cartons per day, the new machine handles 3,000 cartons daily." Model 12 is fully automatic and ties packages from as small as 2 "x 8" up to 22" x 26", making 24 ties per minute.

U. S. Steel Supply
Division of
United States Steel

USS

USS Steel Strapping formerly
Gerrard Steel Strapping

STRAPPING **STRAPPING TOOLS**

STEEL STRAPPING SERVICE

—cuts strapping costs in half

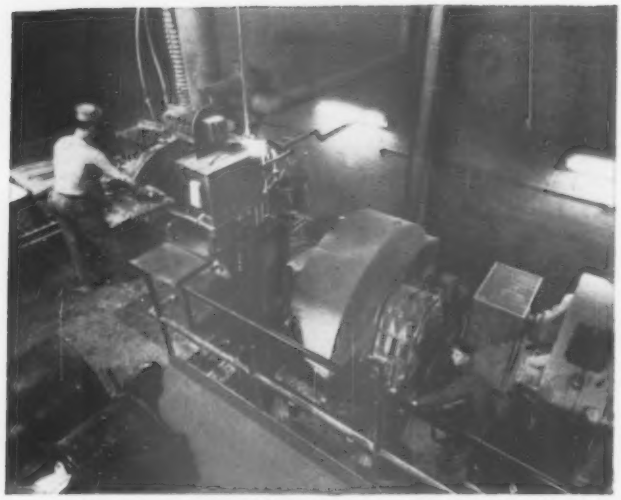
Brightens your profits—USS Round Steel Strapping used by the Model 12 offers a considerable saving in strapping costs. In this regard, the manufacturer says, "The biggest savings we have experienced is in material costs—48% savings on 100-pound cartons and 45% on 50-pound cartons. A pound of round steel strapping (96 feet) will bind more boxes than a pound of flat steel strapping which contains 52.4 feet." Other manufacturers have experienced similar reductions in material costs, some as high as 50%, when they switched to USS Round Steel Strapping.

USS is a registered trademark

Widens your potential—In many operations, the installation of the Model 12 machine has the effect of breaking a bottleneck. Faster tying permits increased production—more units shipped per man-hour. Why not consult a USS Steel Strapping Specialist about the application of Model 12 to your production line? Our Strapping Specialists are thoroughly familiar with industrial packaging problems and production line techniques. They have a wealth of experience to apply to your problems, and are not prejudiced in reaching the best solution. They can offer you either round or flat steel strapping as well as hand-operated, semi-automatic and automatic tying machines. Write for a free copy of our Sweet's Catalog insert for further information. U. S. Steel Supply Division, United States Steel, 208 South LaSalle Street, Chicago 4, Illinois.

TECHNICAL ASSISTANCE

For more facts Circle 475 on Reader Service Card



1. Compounding rubber to be processed into industrial hose. This spiral flow mixer at the Industrial Hose Plant of Swan Rubber Company is lubricated with Gulfcrown Grease and Gulf Harmony oil.

2. Sheeting-off compounded rubber flats, this processing mill is on the floor directly below the mixer. Gulfcrown Grease—a highly stable, water-resistant type—keeps the roll bearings in this mill operating smoothly.

5. Extruding lead overcoating on hose, this lead press has its hydraulic system filled with Gulf Harmony. Lead covering becomes template against which outside diameter of hose is forced under steam pressure, then cured.

6. Braiding reinforcement fibers on industrial hose. The high speed spindles on these braiders at Swan Rubber's Industrial Hose Plant are lubricated with Gulf Precision Grease #2. Gulf Harmony oil lubricates the spindle decks.

Swan Rubber cuts downtime 30% on 300 processing

GULF MAKES THINGS

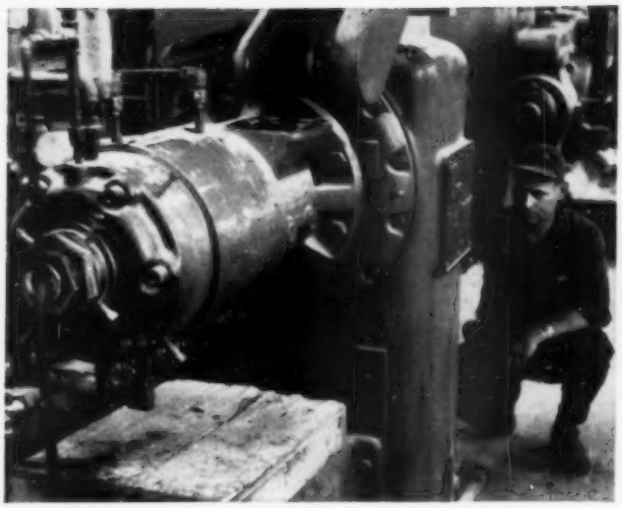
"Over 10 years ago, with the help of Gulf engineers, we set up a comprehensive lubrication plan for our rubber hose production. Since then we have reduced downtime by more than 30% on more than 300 basic processing machines, and hundreds of auxiliary units, using only 6 Gulf greases and 3 Gulf oils."

That's the report from C. B. Jacobs, Plant Engineer of Swan Rubber Company, Bucyrus, Ohio—world's largest manufacturer of garden hose, and also a major producer of industrial hose. 95% of the lubricants in this plant are supplied by Gulf.

Shown above are a few highlights in the processing of industrial hose at Swan Rubber, where Gulfcrown Grease, Gulf Harmony oil and other Gulf lubricants made possible a 30% reduction in downtime.

In over 10 years of Gulf lubrication of Swan's ma-

3. Strip-feeding rubber to extruders for shaping into industrial hose. Gulfcrown Grease lubricates the bearings of this machine—and, as seen here, is also supplied to external components of the machine.



4. Extruding rubber like endless macaroni. This extruder, in another section of the plant, has many precision gears in its speed reduction units which regulate feed and speed. The gears operate in a bath of Gulf Harmony oil.

7. The finished product . . . Swan Rubber's industrial hose, some 300,000 feet of which are produced here daily. Only 6 Gulf greases and 3 Gulf oils provide complete lubrication for more than 300 basic processing machines.

8. Gulf man on the job helps Swan Rubber cut downtime 30% with the right Gulf greases and oils. Right, E. A. Jeffrey, Gulf Sales Engineer, with C. B. Jacobs, Plant Engineer, Swan Rubber Company.

machines using Gulf greases and oils . . .

RUN BETTER!

chinery, there hasn't been a single plant-stopping machine breakdown due to a lubrication problem—strong evidence that Gulf makes things run better.

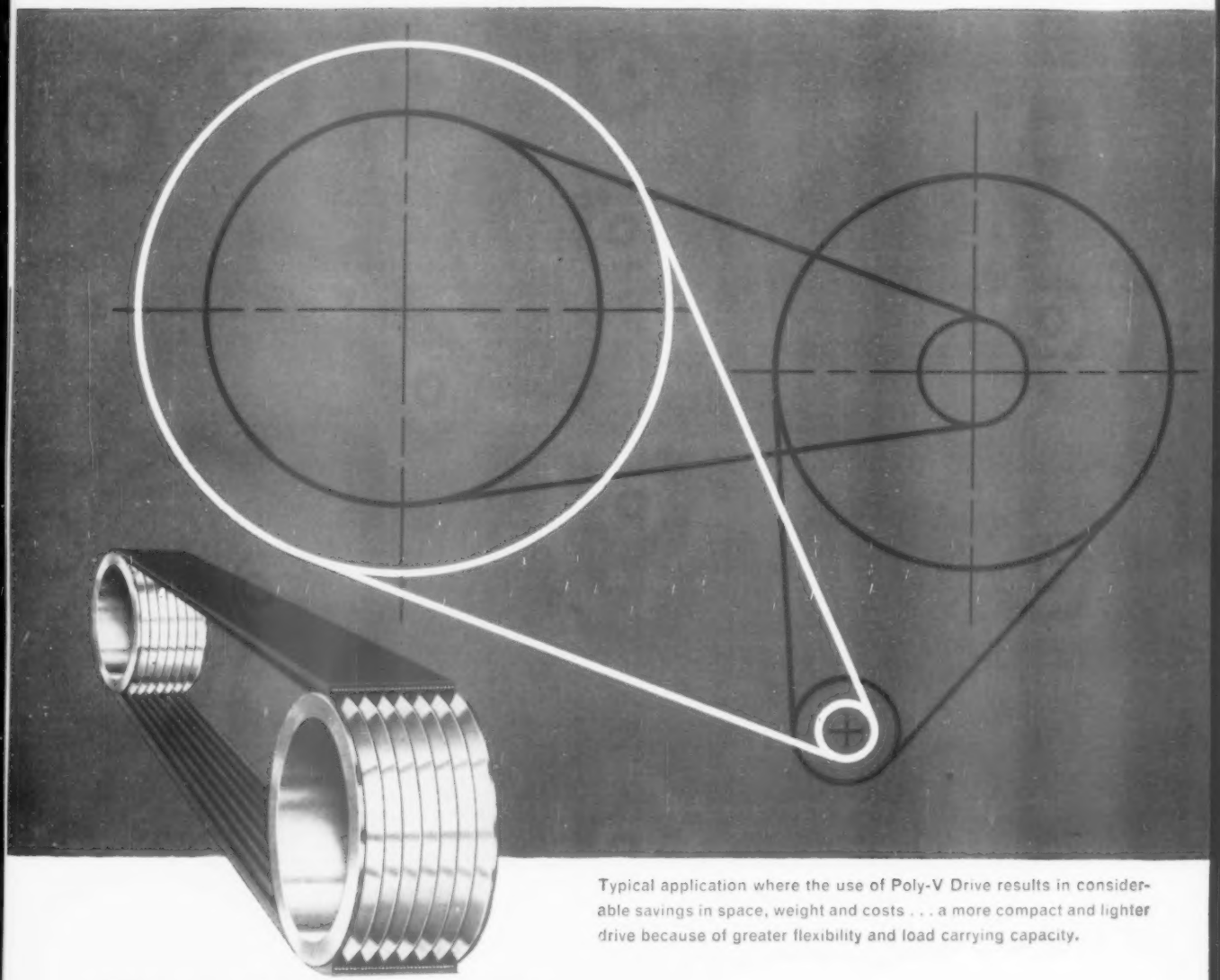
How about your plant lubrication? Gulf engineers can help you reduce downtime and cut maintenance costs. Just call your nearest Gulf office. Or, write for illustrated bulletins on Gulfcrown Grease and Gulf Harmony oil.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

Announcing a NEW Drive Engineering

New DAYTON POLY-V® DRIVES permit



Typical application where the use of Poly-V Drive results in considerable savings in space, weight and costs . . . a more compact and lighter drive because of greater flexibility and load carrying capacity.

NEW DAYTON POLY-V DRIVE

New Dayton Poly-V Drives complete the Dayton line . . . answering many of the design engineers' problems dependent on greater power delivery under the most critical space limitations.

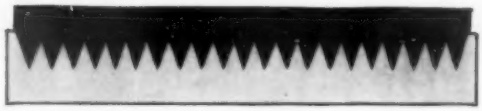
This new concept of power transmission employs a single, endless parallel V-ribbed belt running in sheaves designed to mate precisely with the belt ribs. Single unit design provides twice the tractive surface per inch of sheave width . . . delivers up to 50% more power in as little as ⅔ the space where these requirements are indicated. This means *less* overhang, less bearing load . . . a more compact and lighter drive. Single unit design completely eliminates need for matching belts, helps maintain constant pitch diameter and speed ratios from *no* load to *full* load. You get longer drive life . . . smooth vibration-free performance . . . greater dependability . . .

Service...

wide range of special drive designs...

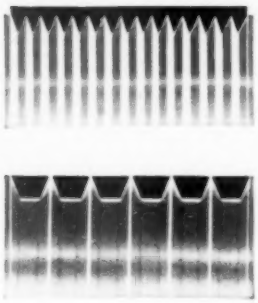
provide for more power in less space

Now from one source, Dayton Industrial Products Company—the most complete line of friction-type drives in existence—for every application from automatic washers and dryers to large industrial machinery and farm implements.

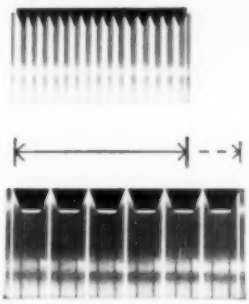


Gives Greater Power Capacity. Full contact with the entire sheave driving surface gives Dayton Poly-V greater power capacity because it has twice the contact area of other drives with half the surface pressure.

Maintains Constant Pitch Diameter at All Loads. Full contact of Dayton Poly-V gives solid support under strength member. Speed ratio doesn't vary. Belt position remains constant from no load to full load.



Delivers More Power. Dayton Poly-V increases the drive capacity 30% to 50% in the same drive width . . . functions as a friction-force-multiplier in the sheave groove. Makes Poly-V ideal where more compact design is essential. Three cross-sections (J 3/32", L 3/16", M 3/8" rib widths) handle all applications.



Saves Space. Narrower drives deliver equal power in less space. In most applications, the width of Dayton Poly-V Drive is 2/3 to 3/4 of the width of standard multiple drives of the same horsepower. Poly-V has higher horsepower capacity per inch of sheave width. Means less shaft overhang, less drive weight, lower drive cost.

DAYTON'S SPECIAL ENGINEERING SERVICE

Make use of Dayton's special Drive Engineering Service when you think of power transmission. The time to call us is when your design is still on the drawing board. We have *no axe to grind* —we'll help you select the Dayton V-Belt Drive (FHP, Multiple Variable Speed or Poly-V) best suited to your specific need.

©Registered trademark of R-M Inc. Manufactured by Dayton Rubber under exclusive license of Raybestos-Manhattan, Inc.

Dayton Industrial Products Co.

Melrose Park, Ill. *A Division of The Dayton Rubber Company*

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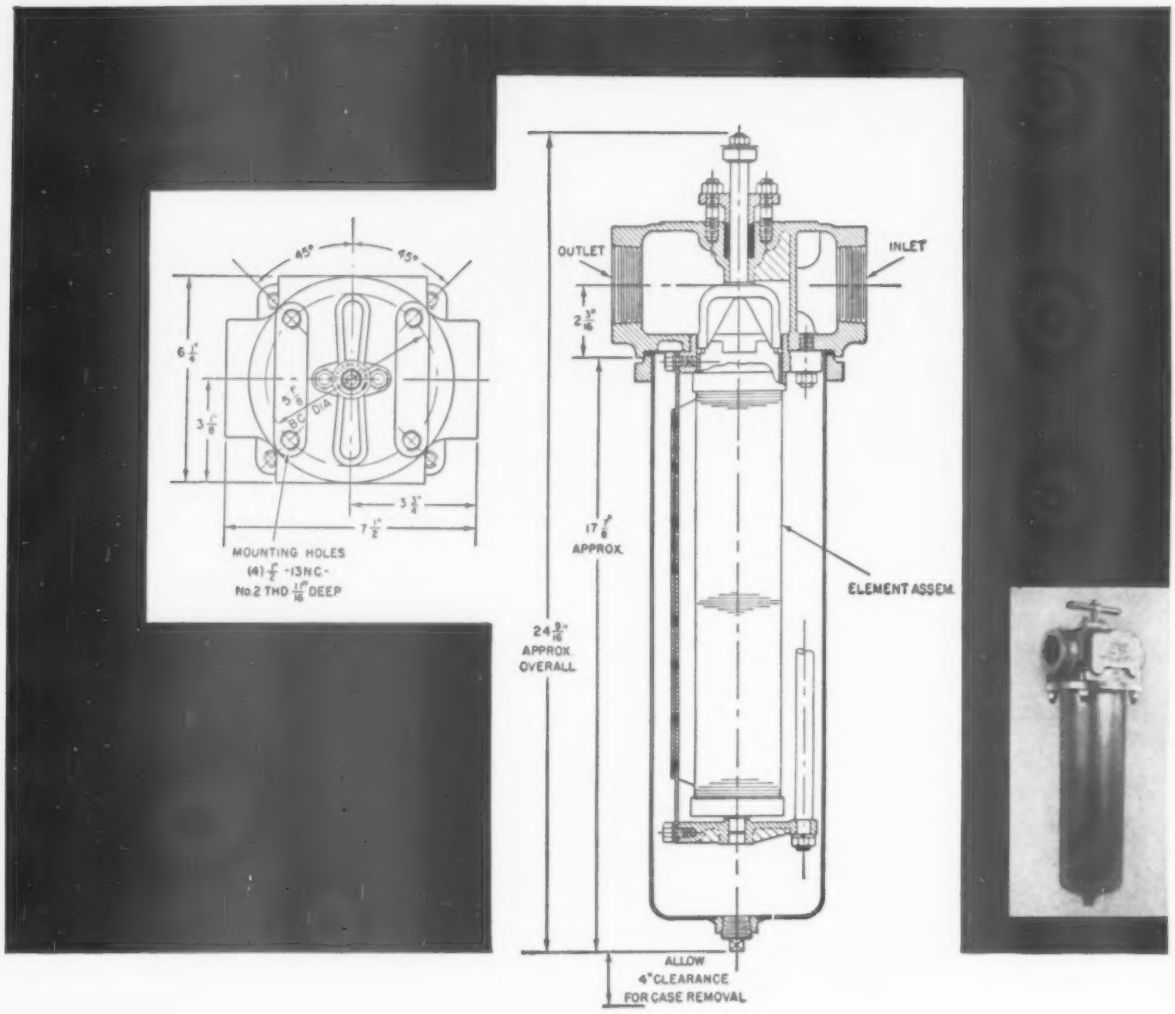
© D. P. Co. '57



This one standard Purolator filter is

EXACTLY RIGHT *for all these fluids:*

inks • paints • varnishes • food products • greases • process fluids • fuel and lube oils

SPECIFICATIONS: This is Purolator filter model G-141J with simplex full flow metal element strainers. It is designed for primary or first stage filtration and can be installed on pressure or suction side of pump. Recommended for capacities of 6 to 233 GPM, dependent on spacing (from .001 to .020 and fluid viscosities). Relief valves set from 10-12 to 50 PSI are incorporated in several models. Motor driven knife blade to clean element can be furnished whenever conditions make manual rotation impractical. Head made of high tensile cast iron, body of drawn steel. Inlet and outlet connections are 2", drain plugs are provided. Maximum pressure: 125 PSI; weight: 37 lbs.

Remember, if these specifications don't match your needs, there's probably a filter that does at Purolator. Find out. Send in your problem.

Filtration For Every Known Fluid

PUROLATOR

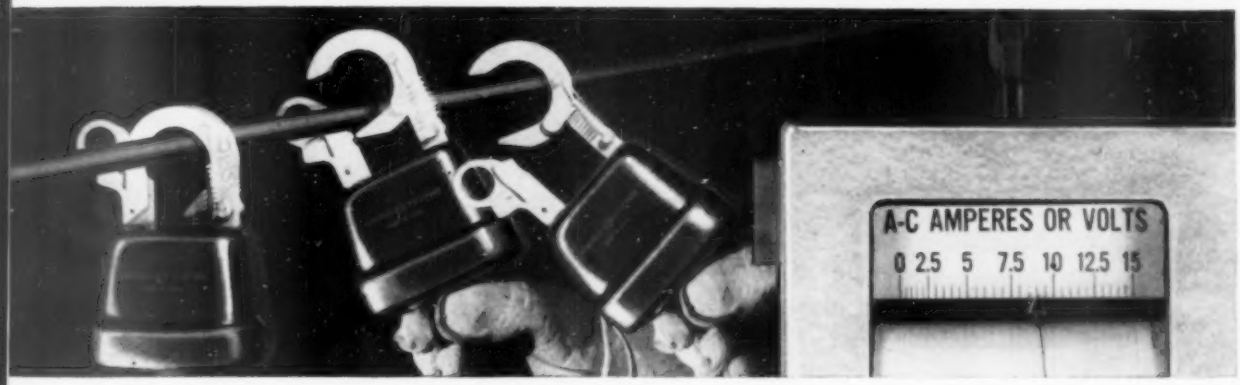
PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

For more facts Circle 478 on Reader Service Card

See LOCAL SOURCES Section This Issue

hooks on, records dips, peaks...



This new General Electric Type CH-7 "hook-on" continuously records all transient dips and peaks up to 750 amps or volts without breaking the circuit or wasting production time. It's portable, inking . . . features throw-away inkwell, 0.7 second response time and 28 chart speeds. ***No power required*** . . . unattended, it operates 60 days indoors or outdoors from a hand-wound, spring-clock chart drive. And the butyl-molded hook-on transformer is now available in ***new 13.2 and standard 8.7 kv-rated insulation.*** Companion portable and switchboard models in the CH inking line record a-c and d-c volts and amps, a-c watts, vars, frequency, and d-c milliamps and millivolts. Or, for an inkless trace, General Electric's ***all-weather*** Type CF-7 portable recorder offers the same hook-on convenience. Indicating Type AK instruments, with trigger-operated hook, give ***quick, accurate readings.*** Range selector rotates with finger-tip pressure . . . only one scale shows at a time. For the complete "hook-on" story just contact your G-E Apparatus Sales Office or Distributor; or write direct to Section 592-103A, General Electric Company, Schenectady 5, N. Y.

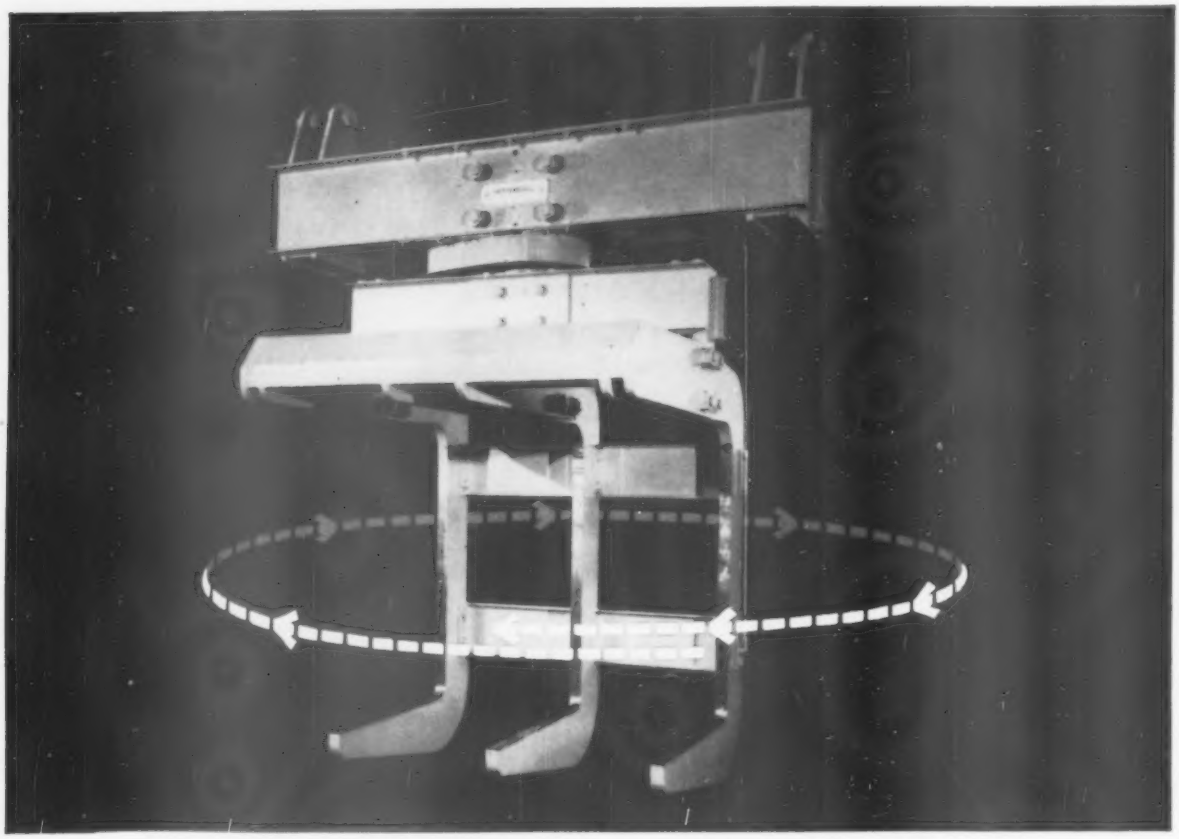
Other General Electric Instruments for Industry — *Switchboard and panel instruments, recorders, indicator and recorder controllers, pyrometers, timing devices, speed and color measurement equipment, laboratory test instruments.*

INSTRUMENT DEPARTMENT

GENERAL ELECTRIC

For more facts Circle 479 on Reader Service Card

NEW Heppenstall motorized slab lifters have continuous 360° rotation



Slabs may be rotated in either direction quickly and easily by this Heppenstall Slab Lifter.

With this lifter, up to 30 tons of steel slabs can be lifted and automatically rotated without limit in either direction. Spreader bars position the three high-tensile alloy steel C hooks on 32-inch centers. The rotating mechanism is contained within a double beam which has two bails on 8-foot centers for double crane hoist mounting. For maximum stability, the load is suspended from the rotator by a rigid, bearing-mounted shaft. The C hooks are counterbalanced to remain level at all times. For more information or a quotation, contact your Heppenstall Company Representative or Heppenstall Company, Materials Handling Division, New Brighton, Pa.

HEPPENSTALL COMPANY PITTSBURGH 1, PENNSYLVANIA

PLANTS: Pittsburgh, Pa. • Bridgeport, Conn. • New Brighton, Pa.

MIDVALE-HEPPENSTALL COMPANY • Nicetown, Philadelphia 40, Pa.

Die Blocks • Forgings • Back-up Roll Sleeves • Rings • Industrial Knives • Materials Handling Equipment
Pressure Vessels • Hardened and Ground Steel Rolls

IF IT HANGS FROM A CRANE . . . HEPPENSTALL CAN HANDLE IT

For more facts Circle 480 on Reader Service Card

Puritan's Engineered Maintenance reduces floor-cleaning and sealing problems for The American Thread Company

A Puritan representative demonstrates correct use of the Advance Floor Machine "Convertamatic" high speed combination scrubber-vacuum.

"We're saving 30% on costs... and our floors stay in better condition longer"

"ENGINEERED MAINTENANCE gets my vote! By applying technical know-how, furnishing adequate supervision, and providing proper supplies and equipment, Puritan has helped us lick a difficult sanitary maintenance problem.

"Frankly," says J. C. Collins, Utility Foreman at The American Thread Company, Sevier, North Carolina, "I didn't think we could ever overcome it, but Puritan showed us how. Now our custodians are proud of the job they are able to do."

The American Thread Company was faced with the problem of paraffin being tracked from area to area throughout its large, modern mill. With the installation of Puritan's ENGINEERED MAINTENANCE program, this condition has been reduced to a minimum with a very considerable saving in cost.

Systemized sanitation

Your plant has its own special requirements and desirable level of sanitary maintenance. The ENGINEERED MAINTENANCE program Puritan recommends for your company is prepared for your individual needs. A specially trained Puritan representative surveys your buildings personally. On the basis of this on-the-scenes report, a team of Puritan specialists prepares day-to-day, week-to-week and month-to-month procedures.

They set these up for you on an engineered basis...train your janitors and porters...call regularly to review progress and provide further training as needed.

This entire program costs you nothing

Puritan means exactly that. No strings. As a user of Puritan sanitary maintenance products you receive the service free.

Meanwhile you are not tieing yourself down in any way. Nationally used Puritan products are competitively priced and fully guaranteed. You are not asked to sign any long-term contract. You pay nothing extra—either directly or indirectly. The burden of proof is upon us.

Frees your time at once

ENGINEERED MAINTENANCE starts to take nuisance details off your hands from the very first day. You have additional hours to devote to management responsibilities... doubly important today when increased investments in labor, materials and equipment place a premium on efficient operation. ENGINEERED MAINTENANCE is a tested method of controlling sanitary maintenance...conveniently ...surely...economically.

A good way to start

Send for "ENGINEERED MAINTENANCE." This new technical booklet shows you precisely how Puritan helps you achieve trouble-free maintenance...cut your company's costs...save your own time.

© COPYRIGHT 1959 PURITAN CHEMICAL COMPANY

PURITAN CHEMICAL COMPANY

EXECUTIVE OFFICES: 916 ASHBY STREET, N. W. • ATLANTA 18, GEORGIA

PLANTS & WAREHOUSES: ATLANTA, GEORGIA • HOUSTON, TEXAS • ST. LOUIS, MISSOURI

For more facts Circle 481 on Reader Service Card

(X) MARKS THE SPOTS

where 4 valves are replaced by 1...

. . . And that one valve is a Rockwell-Nordstrom Multiport lubricated plug valve. Above, it is controlling flow in *four* directions—a multiple job only this type of valve can do.

This could mean big savings in your plant, plus more efficient traffic control of everything you flow through pipe. For instance: A large sugar refinery had trouble efficiently routing slurry to process units. A Rockwell field engineer recommended Multiport valves, since *one* Multiport does the work of *three* or *four* ordinary valves. With fewer valves and simplified piping and fittings, the new installation quickly paid for itself by eliminating costly flow control errors and improving quality. And since Rockwell-Nordstrom is the most *complete* line of lubricated plug valves, the Rockwell field engineer was able to make a number of other valve suggestions for improving flow control, preventing waste, and reducing valve maintenance.

There are literally hundreds of ways Rockwell field engineers are helping manufacturing and processing plants save time, money, and materials through better measurement and control methods. The experience of the world's largest manufacturer of valves, meters, regulators, and other measurement and control products, can pay off for you, too. Wherever gases or liquids flow through pipe in your plant, there is a real opportunity for savings. It will cost you nothing to get the facts. Simply send the coupon.

ROCKWELL

The leading single source for Measurement / Control products and ideas

For more facts Circle 482 on Reader Service Card

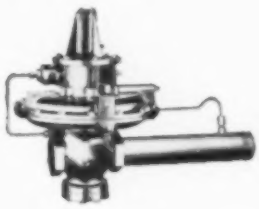
"IN-PLANT" METERING:

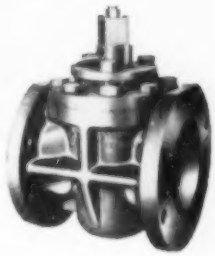
LIQUIDS AND GASES

Rockwell gas and liquid meters, properly applied, can improve quality control, sharpen cost control, and prevent waste in almost every plant department. A Rockwell Field Engineer can help you find *where* meters will cut costs . . . and Rockwell has a complete line of meters to measure practically anything that will flow through pipe.

CONTROLLING PIPED MATERIAL:

LIQUIDS AND GASES





More efficient control of all the material flowing through pipes in your plant is a positive step in cutting costs. There are new applications and new ideas for using gas pressure regulators and valves that will stop wasteful, inefficient, and dangerous handling of fuels, production fluids, and products. A Rockwell Field Engineer can show you *where* and *how*.

HOW MUCH COULD YOU SAVE?

There is hardly a plant of any kind—including yours—where the right application of the right measurement and control methods and equipment won't produce savings many times the modest cost involved. It will cost you nothing to have a Rockwell Field Engineer *show* you. Simply send the coupon below, now.

SEND COUPON NOW!

MEASUREMENT & CONTROL DEVICES

another fine product by

ROCKWELL

Rockwell Manufacturing Company, Pittsburgh 8, Pa. Dept. MCIJ

☐ Please have a Rockwell Field Engineer call me for an appointment.

Please send literature on ☐ Controlling gas pressures; ☐ Valving gases, liquids and slurries; ☐ Measuring liquids; ☐ Measuring gases.

I am concerned primarily with ☐ Light & Heavy Metal Fabricating ☐ Basic Chemical Production ☐ Chemical Processing ☐ Food, Drugs & Tobacco ☐ General Manufacturing Operations ☐ Petroleum Processing

☐ Others: _____

Name: _____ Title: _____

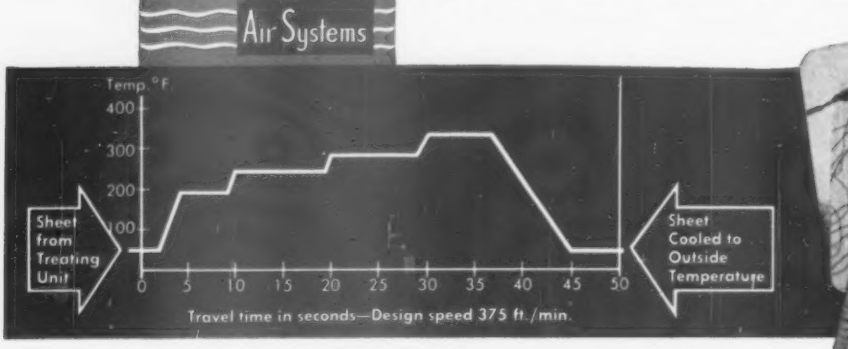
Company: _____

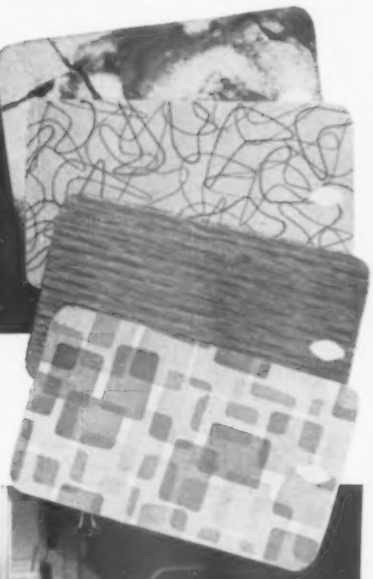
Address: _____

City: _____ Zone: ____ State: _____

ROSS Air Systems

Engineered Atmospheres for Better Processing





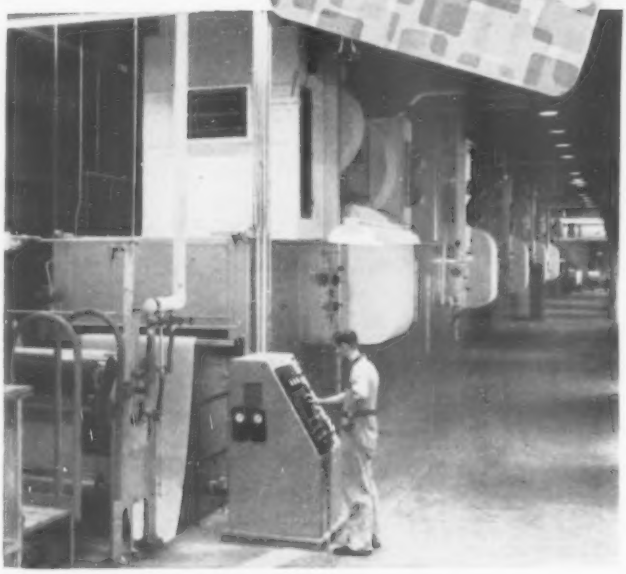
These Temperature Zone PLATEAUS are Critically Important

FORMICA® laminated plastic...long a 'byword' when modernized kitchens are discussed...starts with heavy kraft paper, called Core Stock. But this paper first must be treated properly and then advanced in the oven to insure proper behavior in the final curing process to assure the quality and the durability of the finished products.

The curing of this Core Stock takes place in a large special oven designed and constructed by Ross Engineers. But what takes this operation out of the class of just a routine enclosure with hot air passing through and what puts it definitely in the class of an 'Engineered Atmosphere' is the precise zoning, precise temperature control, and precise circulation of heated air...three steps in the conditioning of the fast moving sheet.

Treated first with phenol-formaldehyde, the kraft paper then passes at a design speed of 375 ft. per minute through a 250 ft. oven (five heating zones and curing plus cooling section) thus heating from 200° F. stepping up to 350° followed by rapid cooling to outside temperature levels. Many engineering problems ...chemical, mechanical, thermal, electrical, instrumentation were involved in the design. All had to be carefully worked out and then integrated to make it a smooth, fast-working, efficient unit.

Further evidence of the broad experience of Ross Engineers in the specialized field of 'Engineered Atmospheres' can be found in the same plant...in the eight Ross Melamine Curing Ovens which prepare the top design sheet and transfer sheet prior to assembling



with the Core Stock. Within these eight ovens, as within the Core Oven, the carefully created 'Engineered Atmosphere' is the heart of the process.

Ross Engineers will be glad to discuss with any company its production problem involving heating, drying, curing, baking, paint finishing, humidifying, treating or otherwise conditioning materials and of related comfort air conditioning and ventilating where an 'Engineered Atmosphere' is the key operating step.

THE MIDLAND-ROSS GROUP OF COMPLEMENTING SERVICES

J. O. ROSS ENGINEERING
Division of Midland-Ross Corporation

730 Third Avenue, New York 17, N. Y.
ATLANTA • BOSTON • MT. PROSPECT, ILL.
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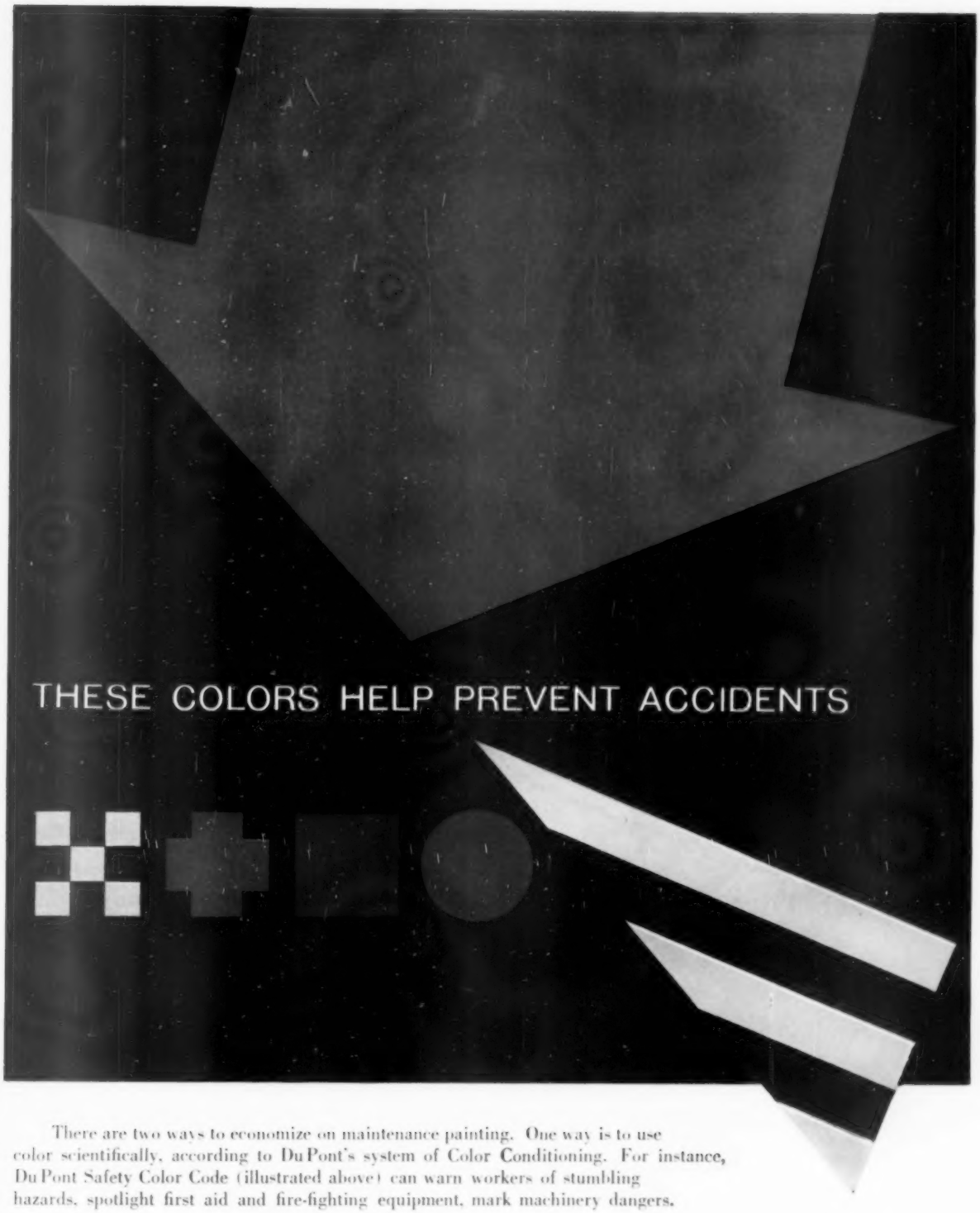

There are two ways to economize on maintenance painting. One way is to use color scientifically, according to Du Pont's system of Color Conditioning. For instance, Du Pont Safety Color Code (illustrated above) can warn workers of stumbling hazards, spotlight first aid and fire-fighting equipment, mark machinery dangers.

Another way is to use good quality paint. Du Pont Paints are an outstanding example. They're tough, durable and right for the job.

A complete plan of Color Conditioning for your plant and technical help on paint problems are yours for the asking. So is our booklet, "How to Put Color to Work." Write: E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. FM-99, Wilmington 98, Del.

DU PONT

Better Things for Better Living
. . . through Chemistry

DU PONT COLOR CONDITIONING PAINTS

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Punching holes in our versatile hardboard panels (Peg-Board*) is just one of the things we do to help you use them to better advantage. Another: a dependable, even prime coat available on many of the 55 different types, textures and thicknesses. See your lumber dealer. For a comprehensive check list of money-saving suggestions, send for our free booklet. Masonite Corporation, Dept. FA-9, Box 777, Chicago 90, Illinois.

*Masonite Corporation—manufacturer of quality panel products.

MASONITE CORPORATION

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2 NEW, ALL-NEW CRANES FROM AUSTIN-WESTERN

A-W CRANES ARE—
- **ECONOMICAL • HIGH PRODUCERS**
- **VERSATILE • EASY TO MAINTAIN**
- **HIGHLY MANEUVERABLE • FAST, MOBILE**

Austin-Western now offers you a complete line of LIFT, CARRY and PLACE equipment . . . designed to make more profit for you in every operation! Investigate. See your nearby Austin-Western distributor today or write us.

ALSO AVAILABLE:

MODEL 210
5-ton range
self-propelled

MODEL 210-P
5-ton range
for truck or stationary mounting

MODEL 220
6-ton range
self-propelled

NEW MODEL 410

10 TON CAPACITY RANGE

- 11' 1" overhead clearance
- Hydraulic topping
- All-wheel drive
- Torque converter
- Continuous 360° boom rotation
- Boom raises to 60° from horizontal
- Short 15' 8" turning radius, 17' 8" w/outriggers
- 25' telescoping boom can be extended to 47'
- Power booster front-steer
- Full hydraulic rear steer
- Hydraulic outriggers
- Gas or diesel power
- Self-propelled; speeds to 23 mph plus
- Unobstructed visibility
- 10', 22' manual boom extensions

NEW MODEL 110

3-5 TON CAPACITY RANGE

- Low 8' 10" overhead clearance
- Hydraulic cable hoist
- Boom swings 220°
- Torque converter
- Power booster steer
- Rear trunnion steer
- Road speed 2-15 mph
- Outlifts all other 3-wheel cranes over-the-side!
- Hydraulic topping
- 18' 7" boom reach
- Unobstructed visibility
- Full reverse transmission
- Dual front driving wheels
- Gas powered, self-propelled
- Boom raises to 50° from horizontal

Available with wide range of accessories for added versatility!

Austin 1859 AUSTIN WESTERN 1959 100th YEAR PARTNERS IN PROGRESS **Western** CONSTRUCTION EQUIPMENT DIVISION AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes

BALDWIN BLH LIMA-HAMILTON

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Infra-Red
heating comfort
WITHOUT DUCTS, BLOWERS OR HEAT EXCHANGERS

WITH

Perfection **Infra-Red GAS Heaters** *Schwank*

Fired by Natural, LP or Manufactured Gas

"Our high ceilings presented a difficult heating problem. However, with your Infra-Red Heaters our heating situation is absolutely perfect and the savings on fuel is most gratifying", says R. C. Sheets, Vice President of the Solem Machine Co., Rockford, Illinois.

"What has pleased us so immensely is the perfectly controlled temperatures that are maintained day and night; even during sub-zero weather. Most of our workmen wear only light tee shirts!"

Add to this a 97% reduction in electric power consumption; no maintenance headaches because there are no moving parts; low annual fuel costs; and you will understand why over 15,000 users of Perfection Schwank Infra-Red Heaters are equally as enthusiastic. CALL, WRITE OR WIRE FOR COMPLETE INFORMATION AND LITERATURE.

MATCH THESE FACTS WITH *ANY* OTHER HEATING SYSTEM!

Building Size: 200′ x 250′ x 28′ with 50′ x 50′ high monitor running the 250′ length—a total of 1,735,500 cu. ft. (not including office)

Construction: Galvanized sheet metal wall and roof with 1½" aluminum vinyl-faced fiberglas insulation throughout. Three large overhead doors—three small walk-in doors

Mounting Heights: 82 units installed at 26′—28′—42′—48′

Temperatures: 70° during working hours—60° nights & weekends

Degree Days: 5118

Installed BTU: 3,888,000

Fuel Consumption (Infra-Red): 43,969 gal. Propane at 10¢ (a total of $4,396.80 for the period studied)

Electrical Cost (estimated for Infra-Red): $14.00

Estimated Heat Loss (computed on ASHRAE basis): 3,640,000 BTU per hr.

Average Inside Temperature: 63.5° F

Degree Days For Period (base of 58.5): 4378

Probable Fuel Consumption (ASHRAE—efficiency of 80%): 5,975,000,000 BTU

Actual Fuel Consumption (Infra-Red): 4,020,000,000 BTU

Period of Study: November 19, 1958 to March 13, 1959

Perfection industries 1135 Ivanhoe Rd., Cleveland 10, Ohio

division of Hupp Corporation / licensee of American Infra-Red Radiant Co.

Under Schwank U. S. Patents 2775294 and 2870830 and pending applications

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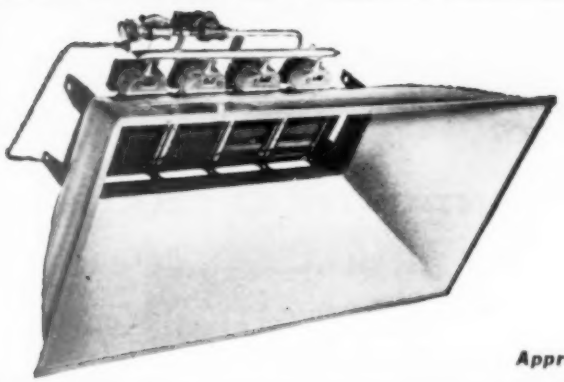
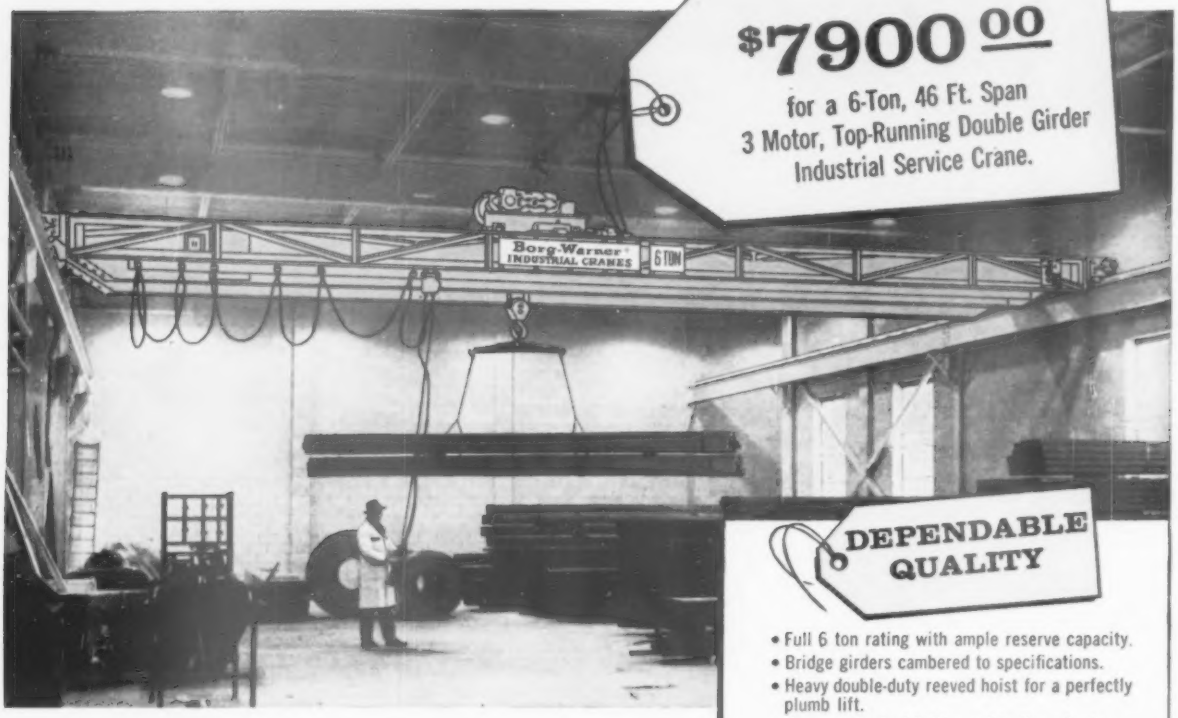


WARM THE MAN AND THE JOB
... *NOT* THE AIR

The rays of heat energy from these generators, like the rays of the sun, heat only the objects they touch and are not wasted on the air around the objects. Once the energy waves strike a person in their path, or the floor, wall or machinery, they are transformed into heat. The result is uniform heating comfort no matter how fast temperatures change.

Approved by American Gas Association, Underwriters, C.G.A. and C.S.A.

Now you can afford Borg-Warner Quality in your next overhead Crane...



Advanced engineering and standardization make...

Borg-Warner Industrial Cranes

BETTER VALUES at LESS COST

Borg-Warner crane engineers and production men have taken a new look at the entire line and come up with important economies through extensive use of standardized interchangeable components. Because these savings are passed along to you, you get more crane for your money when you specify Borg-Warner Industrial!

Efficient overhead materials handling pays off. You get more overhead storage space than fork truck handling provides. You benefit from aisles and work areas uncluttered by floor-type handling equipment. You can reach all areas under the crane, the full length of the runway.

If you are planning a new factory building, an addition to present facilities or a modernization program, it will pay you to look to Borg-Warner Industrial Cranes for the best values in overhead materials handling equipment.

DEPENDABLE QUALITY

- Full 6 ton rating with ample reserve capacity.
- Bridge girders cambered to specifications.
- Heavy double-duty reeved hoist for a perfectly plumb lift.
- Heavy duty steel bridge and trolley wheels.
- All welded jig bored, jig assembled end trucks.
- Long life precision ball and roller bearings throughout.
- Precision assembly of girders and end trucks with fitted bolts in reamed holes.
- Outrigger machinery girder construction.
- Magnetic bridge brake.
- Heavy duty gear reduction bridge drive.
- Fluid coupled bridge and trolley drives.
- Full magnetic push-button floor control.

ADVANCED DESIGN

The crane illustrated is a typical double girder installation. Span may be shorter or longer with greater or smaller capacity and for lighter or heavier duty, intermittent or continuous. Whatever your overhead handling requirements Borg-Warner Industrial Cranes can supply your needs with quality equipment at a price you can afford!

Industrial CRANES — INGERSOLL PRODUCTS — B-W — BORG-WARNER

Design it better . . . Make it better.

Find Your Nearest Distributor Under CRANES In The Yellow Pages

Distributors in all principal industrial cities.

Borg-Warner® INDUSTRIAL CRANES

1540 S. PAULINA STREET, CHICAGO 8, ILLINOIS

Export Sales: Borg-Warner International, 36 South Wabash St., Chicago 3, Illinois

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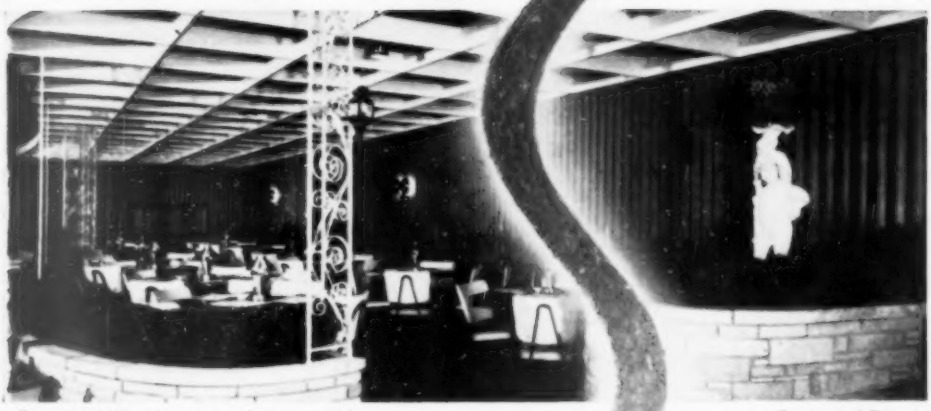

Corrugated Transite sheets add eye appeal to lounges and terraces.

Corrugated Transite sheets provide rugged service for industrial and commercial buildings.

CORRUGATED *asbestos* TRANSITE®

...for eye appeal—

...for rugged service

Johns-Manville Corrugated Transite sheets wear like stone. They are made of two virtually indestructible materials—asbestos and cement. Corrugated Transite can't burn, can't rot, can't rust—requires practically no maintenance.

Use it inside or outside—paint it a color or take advantage of its innate stone-gray attractiveness—use it with other materials for contrast or variation—use it alone to emphasize the light and shadow of the corrugations.

Sheets of Corrugated Transite are 42″ wide (10 corrugations) in lengths up to 12′—cover big areas quickly with minimum framing. For full information on this versatile material, send for the free 32-page brochure, "Corrugated Asbestos Transite." Write to Johns-Manville, Box 158, New York 16, N. Y. In Canada, Port Credit, Ont.

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS

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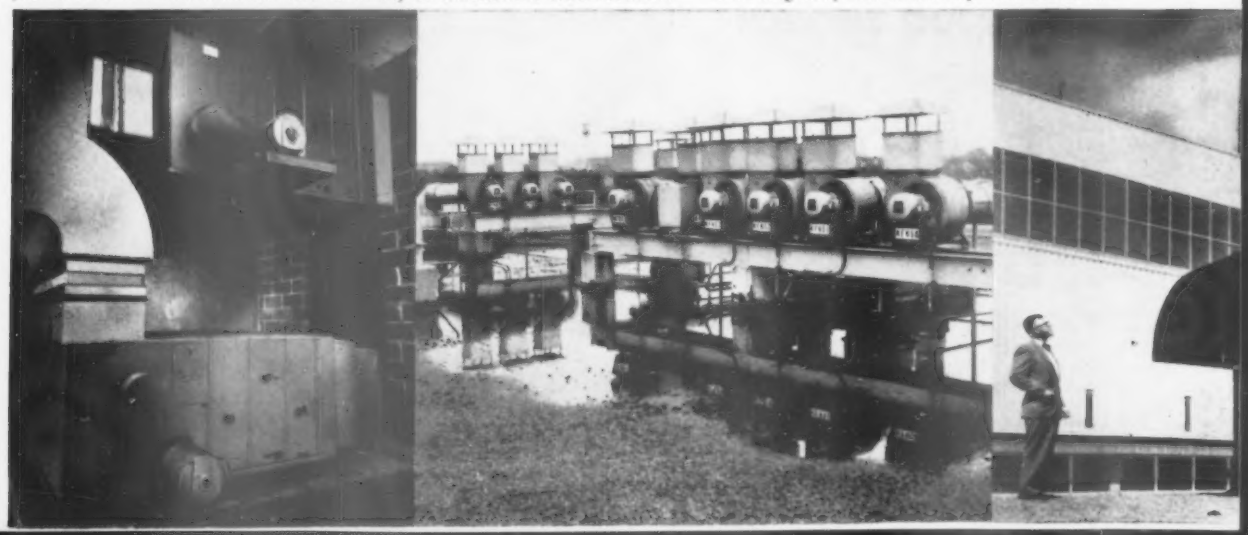
For more facts Circle 490 on Reader Service Card ➤

HIGH EFFICIENCIES of modern fans reduce horsepower load, save you money on big installations.

AIR CONDITIONING CABINETS are available to suit every job. Units can be supplied to cool, temper, humidify, dehumidify, filter and wash your plant air. Zone control cabinets offer a variety of climates for different areas.

CORROSIVE FUMES can be handled with special fiberglas, cast iron or rubber lined fans to greatly reduce fan replacement costs.



Modern Air and Liquid Handling Equipment Can Lower Your Plant Operating Costs!

Modern air and liquid handling procedures can actually help reduce your plant operating and maintenance costs. Here are several brief tips to help you take advantage of the latest in air and liquid handling practices.

COMFORT OR PROCESS AIR COOLING, one phase of air conditioning, can do wonders to reduce absenteeism, increase worker output and improve quality control. Modern planning should include air cooling in all work space, where practical, in addition to offices, cafeteria, and other areas.

ADEQUATE PLANT VENTILATION can frequently give you many of the benefits of air conditioning at greatly reduced cost. New high-efficiency power roof ventilators in capacities up to 250,000 cfm are available to supply fresh air for, or exhaust from, large open areas. These units when used for supply can be equipped with heating and cooling coils, and filters. Duct work is usually not necessary or is held to a minimum.

HIGHER EFFICIENCIES of modern fans can mean substantial savings in power costs where a number of very large centrifugal fans are required. And several modern fan wheel designs are available to cope with special pressure and velocity conditions.

CORROSIVE FUMES, long the downfall of ordinary fans, can be handled with special cast iron, rubber lined or fiberglas fans. Longer fan life, reduced maintenance and less downtime more than compensate for the added first cost sometimes encountered in those special application fans.

PROCESS AIR CLEANING is often expensive and in many instances, cannot be considered a cost reducing move. However, in some cases, effluents have been recovered for reuse and improved working conditions can help defray the cost of an air cleaning system. Then too, elimination of such a nuisance usually results in better community relations.

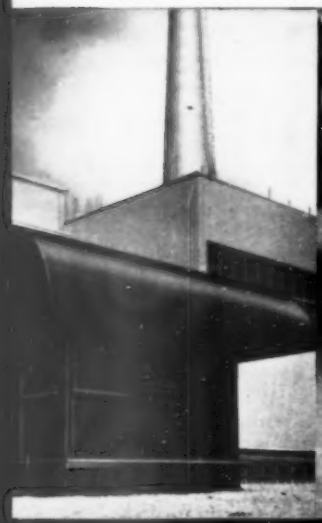
LIQUID COOLING in water shortage areas is becoming more of a problem. New developments in air cooled condensers offer a low cost trouble-free way to cool almost any liquid from an air conditioning installation to engine jacket water.

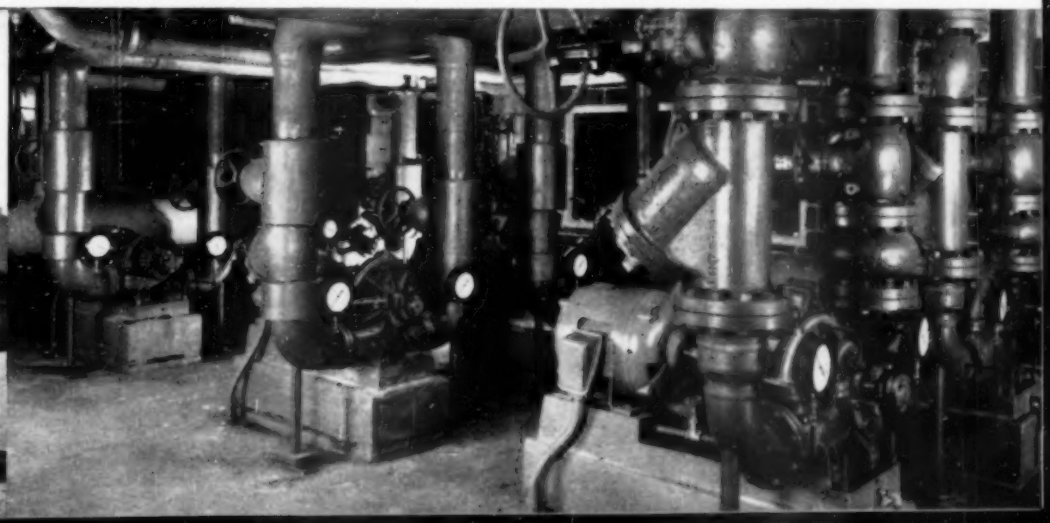
REDUCED PUMPING COSTS can result from the use of modern, high efficiency pumps. Lower parts inventory is possible through parts interchangeability where offered. Special design features and a variety of alloys are available to handle tough applications.

If you would like to incorporate the many advantages of modern air and liquid handling equipment in your modernization plan or new construction, phone your "Buffalo" Engineering representative; **Buffalo Forge Company, Buffalo, N. Y., Buffalo Pumps Division, Buffalo, N.Y.**

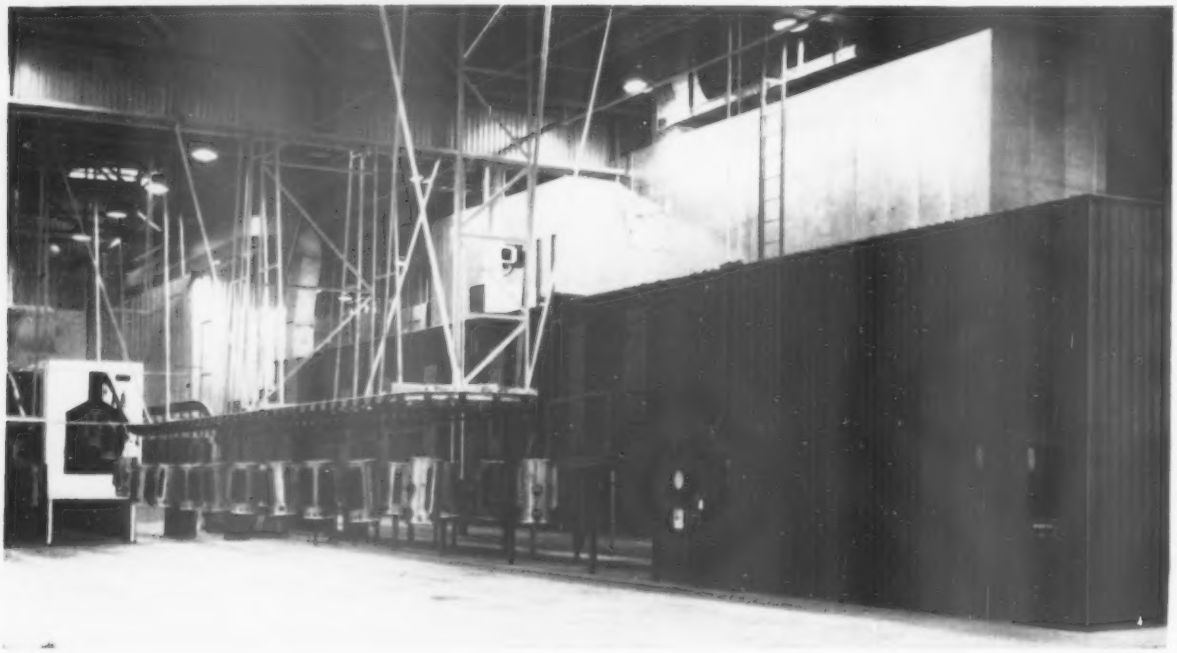
VENTILATING LARGE OPEN AREAS. Large open areas can be ventilated, heated and/or cooled with huge power roof ventilators. Fewer units needed at lower installation costs.

KEEPING PUMPS ON THE JOB is easier, less expensive when you take advantage of parts interchangeability, special design features for unusual jobs, and alloy construction on corrosive or abrasive service.

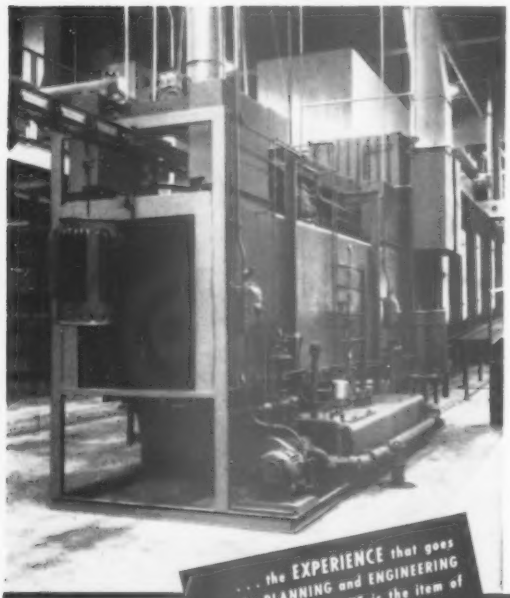




FINISHING SYSTEMS . . .



Mahon Combined Flow Coating and Spray Painting Machines Paint Transformer Tanks Automatically at Westinghouse!



. . . the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!

In a complete automatic Finishing System, recently installed by Mahon in the Westinghouse plant at Athens, Ga., transformer tanks with recessed bottoms are painted automatically, inside and outside, in an inverted position as they pass through specially designed, combined Flow Coating and Automatic Spray Painting Machines—tanks are rotated as they pass through the two simultaneous coating processes. Four coats of paint are applied and each is oven-baked on one continuous line that passes through Four Automatic Painting Machines—one is shown at left.

Other Mahon equipment in this Westinghouse plant includes a Transformer Coil Dehydrating Oven and a second Complete Mahon Finishing System for applying the final coat on completely assembled transformers.

If you are considering a new finishing system, or any unit of finishing or processing equipment, you will want to discuss methods, equipment requirements and possible production layouts with Mahon engineers . . . you'll find them better qualified to advise you, and better qualified to do the initial planning and engineering which plays such an important role in the ultimate operating efficiency of specially designed equipment of this type.

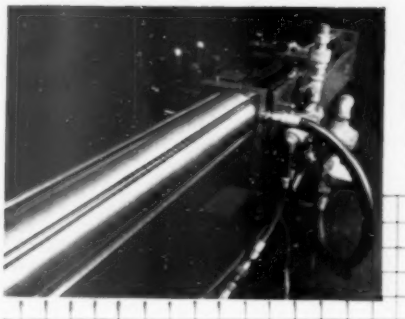
THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York, Chicago and Los Angeles

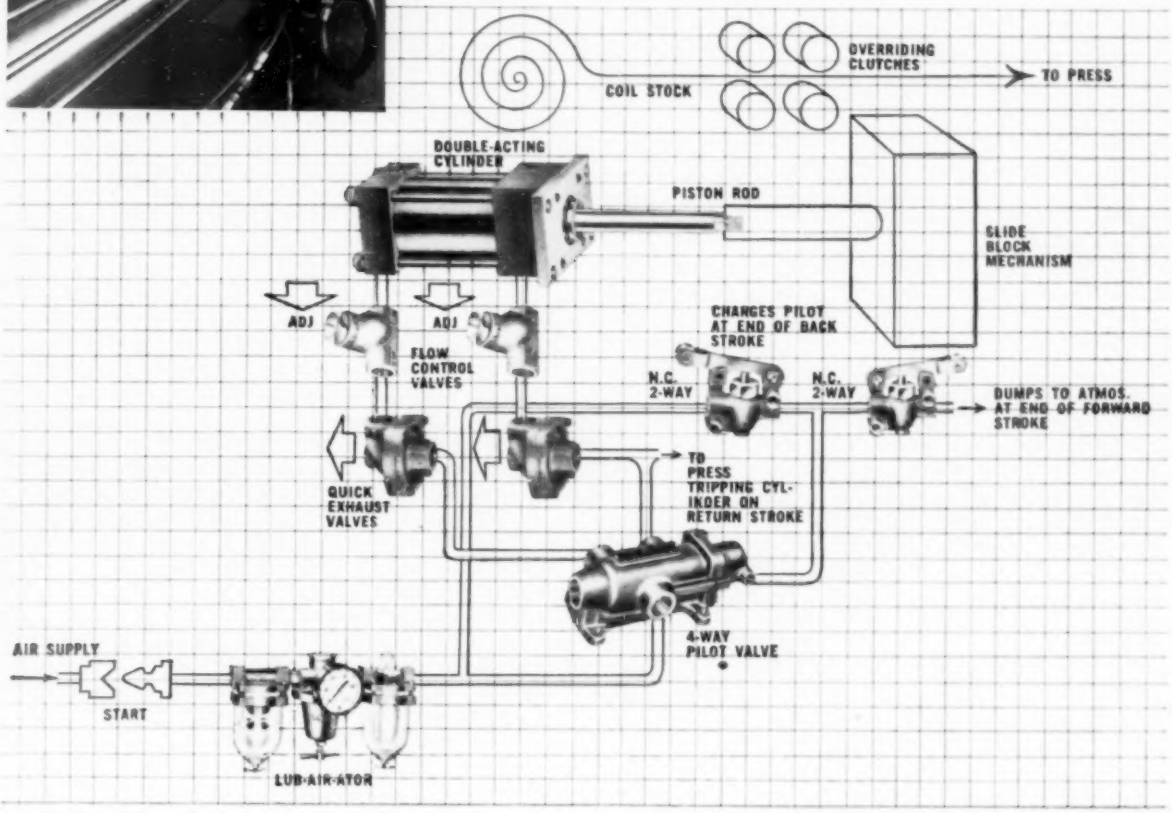
Engineers and Manufacturers of Complete Conveyorized Finishing Systems: Metal Parts Washers, Metal Cleaning and Rust Proofing Machines, Conveyorized Cleaning and Pickling Machines; Dry-Off Ovens, Spray Booths, Electrostatic Spray Enclosures, Flow Coaters, Dip Coaters, Finish Baking Ovens, and Paint Stripping Equipment; Core Ovens, Soldering Ovens, Dehydrating Ovens, Heat Treating and Quenching Equipment for Aluminum and Magnesium; Dust and Fume Control Installations, and Many Other Units of Special Plant and Production Processing Equipment.

See Sweet's Plant Engineering File for Information and Representative Installations, or Write for Catalogue A-659

MAHON



This is an example of how OEM use Schrader. The hookup of Schrader Air Products in the large schematic is used by the Cooper-Weymouth Company of Stratford, Connecticut, to operate its patented power press slide-feed. Power to the mechanism is supplied by a Schrader double-acting cylinder, the front head of which is machined as an integral part of the overriding clutch. At the end of the forward stroke, the slide block operates a normally-closed 2-way valve, which dumps the pilot of a 4-way control valve. This reverses cylinder piston, and the slide block mounted on it, to return for the next stroke. Another normally-closed 2-way valve ahead of the pilot charges the 4-way pilot in a conventional reciprocating motion arrangement to start the next cycle.



ORIGINAL EQUIPMENT MANUFACTURER BUILDS STANDARD SCHRADER AIR PRODUCTS INTO AUTOMATIC TOOLS FOR SPEED, PRECISION

If your company *manufactures* machines or equipment that must push, pull, hold, position or move work repetitively . . . consider the advantages of actuating them with air. Schrader makes complete lines of Air Products that can do such jobs with dependable precision. In limitless combinations, they adapt to many special needs.

Air offers manufacturers much more than versatility. It's fast and accurate, can time to fractions of seconds at high speeds. Its economy alone is a powerful sales point. Safe, tireless, air power is simple that problems of weight, assembly, production and maintenance are enormously reduced.

These are benefits all customers look for. Add them to your products by actuating with Schrader . . . finest, most complete lines of Air Cylinders, Valves and Accessories.

Select from the full Schrader lines to plan your automation of machines. Your Schrader distributor can help you pinpoint what you need. For more data write:

Schrader®
a division of SCOVILL

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
457 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

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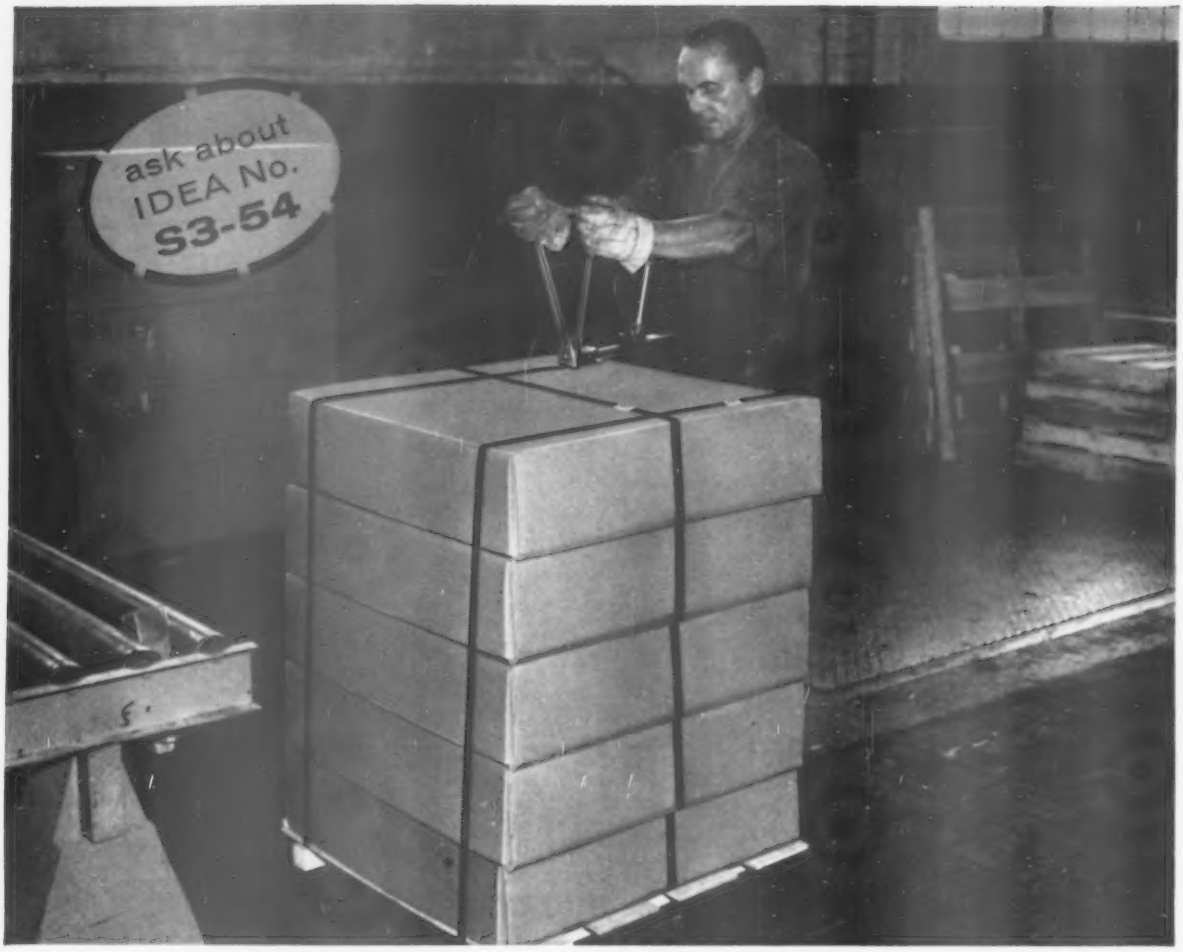

Check your AIM*... American Brass Company does ...

Steel Strapping unitizes boxes of copper tubing

AMERICAN BRASS COMPANY, DETROIT, MICHIGAN, uses corrugated boxes to ship coils of copper tubing. These boxes are easy to handle, provide adequate product protection, and are reinforced and palletized with Acme Steel Strapping. (Idea S3-54)

Acme Idea Man M. J. Meehan works with American Brass and other companies in solving their shipping and material handling problems.

The coils are packed in heavy corrugated boxes reinforced with one strap. Five strapped boxes are secured to a pallet by two straps. This easy, one man operation makes a neater, easier-to-handle shipment. Customers like this method, too, because units are easier to warehouse, take less space, simplify inventory and arrive undamaged.

***Check your Acme Idea Man.** His years of experience helping others solve shipping and material handling problems will help you save time and money. Call or write: Dept. FAS-99, Acme Steel Products Division, Acme Steel Company, Chicago 27, Illinois. In Canada, Acme Steel Company of Canada, Limited, 743 Warden Avenue, Toronto 13, Ontario.

ACME STEEL **STEEL STRAPPING**

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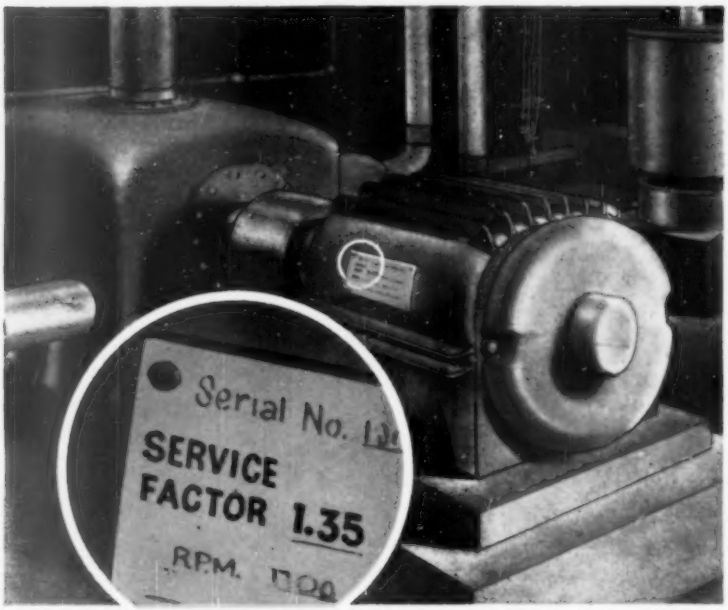
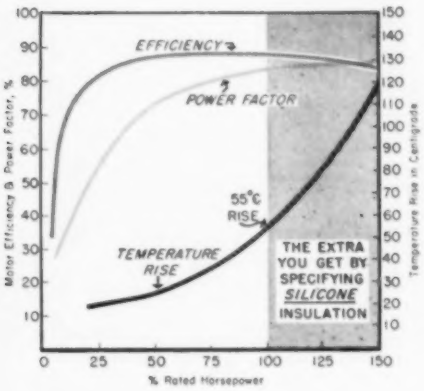
New Service Factor Motors Cut Costs





Specify High Service Factor Motors for lowest initial cost, lowest operating costs . . . maximum reliability.

Leading manufacturers now offer motors designed to an entirely new concept. These motors are available in standard NEMA frames of the same size used for conventional motors of the same rating, but look alikes don't perform alike.

These new motors, insulated with Dow Corning Silicones, have a built-in reserve to carry overloads of twenty-five to fifty percent above nameplate horsepower rating. Here's what this means to you:

Simplified Motor Specifications: Specify motors that are silicone insulated for high service factor. With nameplate horsepower ratings identical to nominal loads, these motors will handle temporary, or even continuous overloading. No need to calculate maximum possible load and add a safety factor. It's already built in.

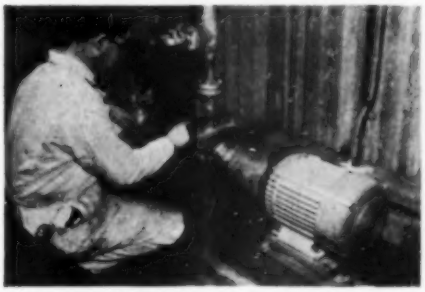
More Efficient Power Use: Power factor problems are reduced . . . excessive power bills resulting from part-load motor inefficiencies are brought in line. Because motors operate at rated output, the need for capacitors to correct power factor is substantially reduced.

Less Installed Horsepower: With motors rated to match normal loads, total installed plant horsepower will be substantially less. Using conventional methods of determining distribution system needs, transformer and switchgear requirements are lower—less costly units can be safely specified.

Motors insulated with Dow Corning Silicones for high service factors are available now from leading motor builders. For more information on what silicone insulated equipment can mean to you, write **Dept. 5121,**

How do manufacturers build so much extra into a motor? By substituting an insulation system made from Dow Corning Silicones for the Class A insulation system used in standard lines. Only the insulation changes. Frame, electrical steel and copper remains the same. And there's one change on the nameplate.

Service factor rating goes up. On a TEFC motor, for example, service factor goes up from 1.00 with Class A insulation materials to somewhere between 1.25 and 1.50 when silicones are used, depending on manufacture and horsepower rating.



Handling liquid of varying viscosity, this 5 hp, 1.25 service factor motor withstands overloads, including those created by excessive tightening of pump packing glands.

Motors insulated with Dow Corning Silicones give reliable operation in almost any surroundings—regardless of high ambients, moisture, many corrosive atmospheres. And on the basis of capability, high service factor motors generally cost less than conventional motors.

SPECIFY Dow Corning Silicones and SAVE!

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

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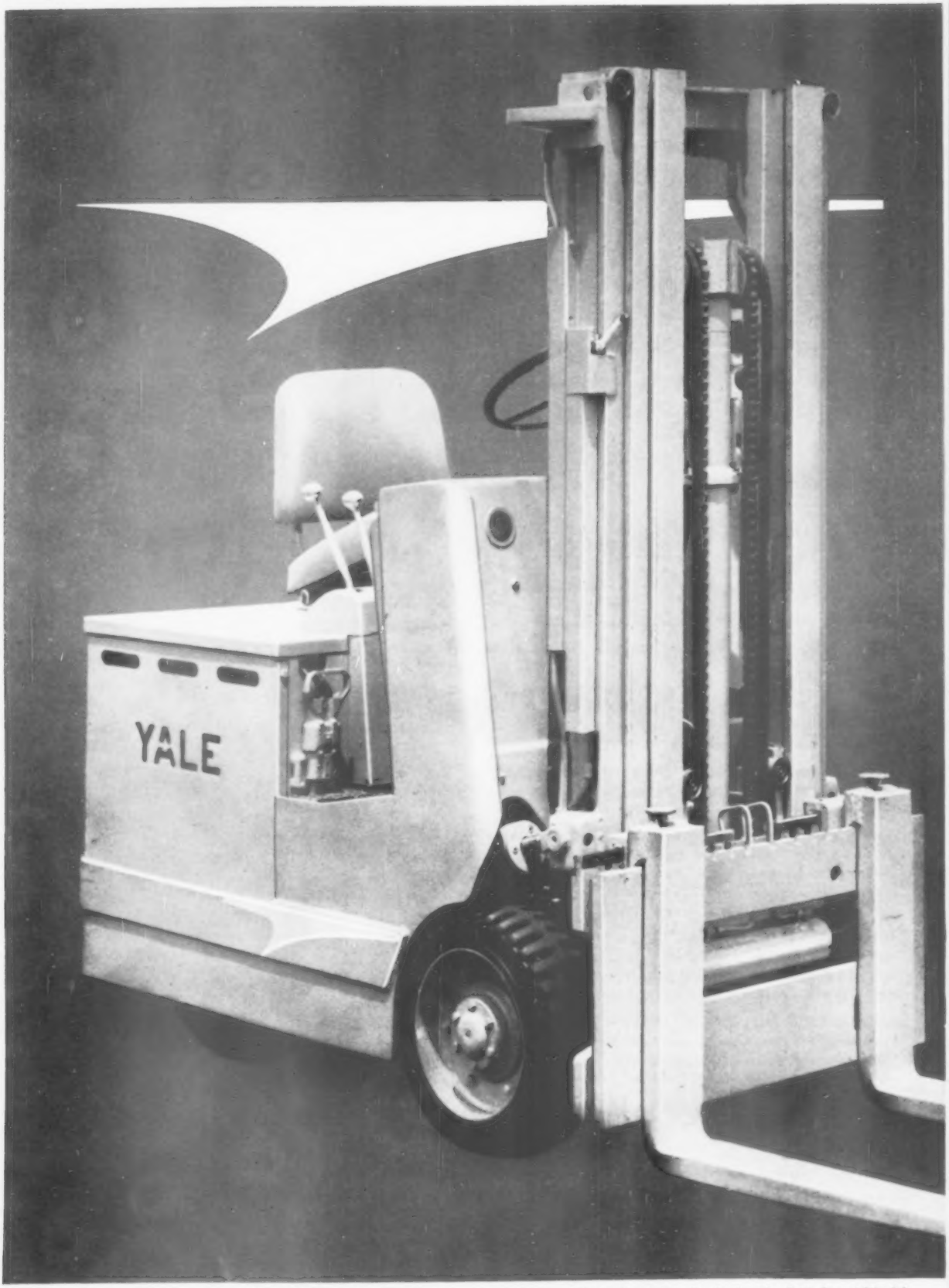


Yale Materials Handling Division, a division of The Yale & Towne Manufacturing Company. **Manufacturing Plants:** Philadelphia, Pa., San Leandro, Calif., Forrest City, Ark.

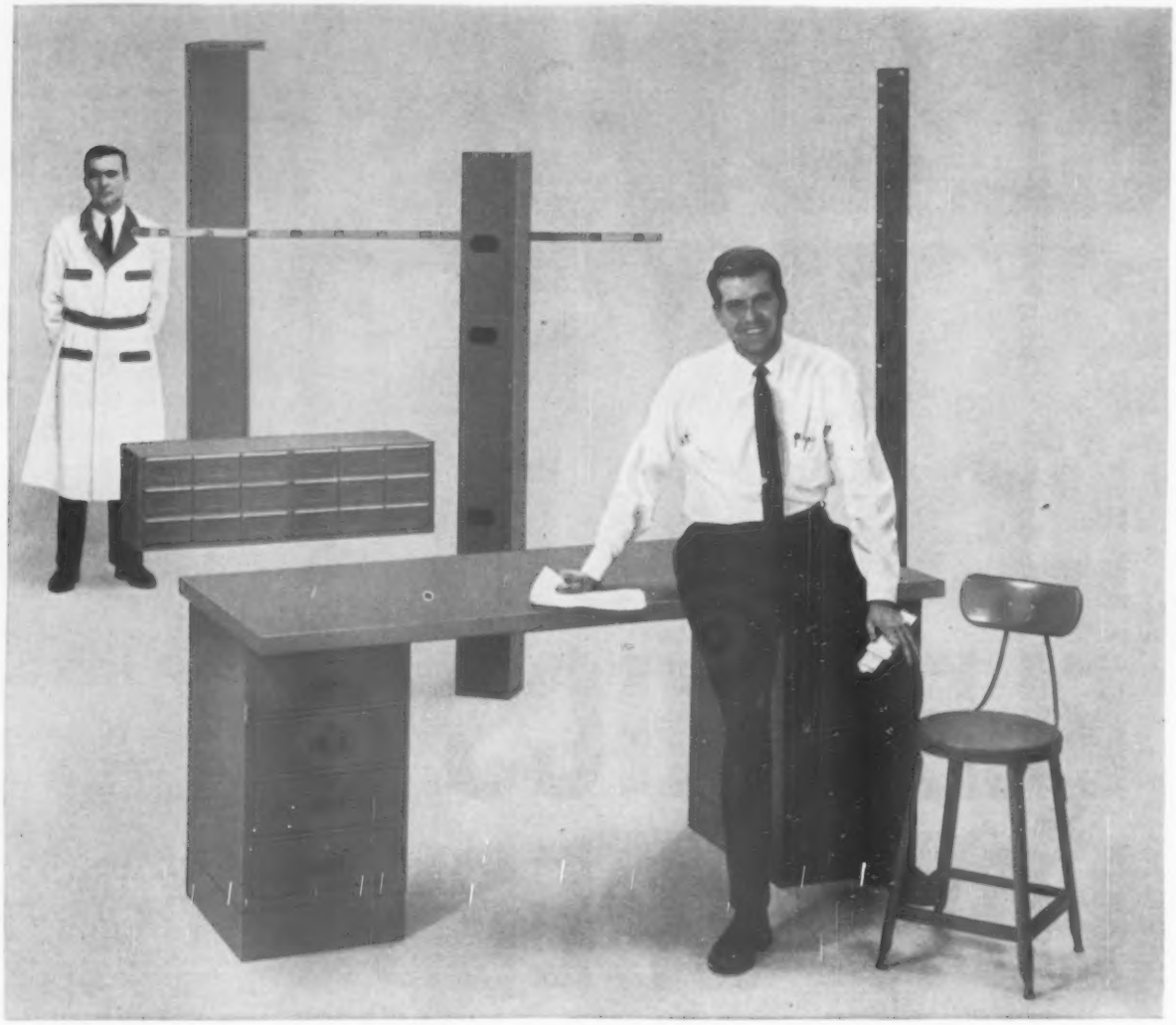
NEW CONCEPTS IN DIMENSIONS FROM YALE

NEW YALE ELECTRICS • LOW • SPEEDY • MANEUVERABLE

Mechanically actuated carbon pile provides smooth speed control... produces infinite motor speeds to suit any operation cycle. Dual caster wheels mounted on ball bearings provide easy steering. Short turning radius. 71" height Triplex Mast available to give 144" fork height. Other features: hydraulic wheel brakes, removable battery box, H-I single lever control for multiple function attachments. Capacities: 2,000, 3,000 lbs. For full information, contact your Yale representative or write The Yale & Towne Manufacturing Co., Materials Handling Div., Philadelphia 15, Pa., Dept. KT4-H.

YALE®
INDUSTRIAL LIFT TRUCKS
TRACTOR SHOVELS • HOISTS
YALE & TOWNE

Products: Gasoline, Electric, Diesel and LP-Gas Industrial Lift Trucks • Worksavers • Warehousers • Hand Trucks • Industrial Tractor Shovels • Hand, Air and Electric Hoists



The work bench with a thousand ideas

Let's forget how people got along before the Hallowell Unit Work Bench arrived — for here is a bench loaded with personalized ideas for you.

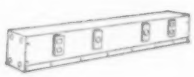
Drawers if you want them, doors if you want them, adjustable shelves, top shelves, Wiremold or electrical panel sections, storage wall units—choice of tops.

You can butt them end to end, join tops midway on cabinet, arrange them back to back, or rearrange them later with ease. It adds up to custom quality and custom adaptability at standard bench prices.

CUSTOM-TAILOR HALLOWELL UNIT WORK BENCHES TO YOUR SPECIFIC NEEDS

Doors or drawers—either or both

Backboard or Top Shelf



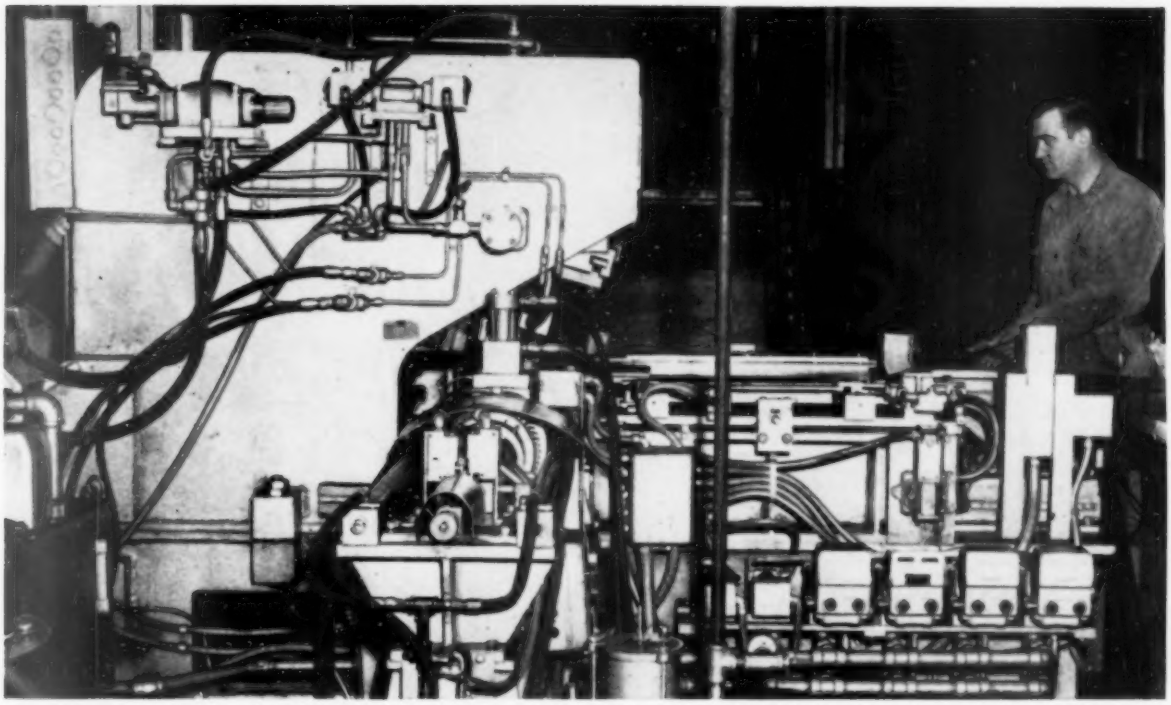
Electrical Panels

. . . or combinations of these and other accessories available from stock.

See your authorized Hallowell Distributor or write direct

COLUMBIA-HALLOWELL Division SPS JENKINTOWN 11, PA. • SPS WESTERN, SANTA ANA, CAL.

For more facts Circle 496 on Reader Service Card



This machine rolls and welds muffler shells. Hydraulic pressure and return lines are Aeroquip Flexible Hose Lines which replaced rigid tubing.

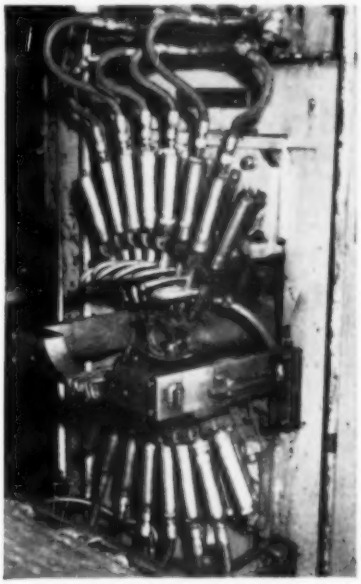
Hydraulic Line Leakage Problems Solved With Aeroquip Flexible Hose Lines

at Walker Michigan Division,
Walker Manufacturing Company of Wisconsin

Semi-automatic metal forming and welding equipment is used at Walker Michigan Division's Jackson plant in the production of automotive mufflers. On equipment using rigid tubing, leaking hydraulic lines were a common maintenance problem. Tubing failures were caused by vibration of the equipment during operation.

Walker maintenance men solved this problem by replacing rigid tubing with Aeroquip Flexible Hose Lines. Assembled quickly in the plant using Bulk Hose and Reusable Fittings, these replacement hose lines have given long, trouble-free service.

If you have a fluid line problem of any kind, you can rely on your local Aeroquip Distributor to help solve it. He's a fluid line specialist. Call him today, or write us.



Aeroquip Hose Lines on this multiple transformer welder have given long, leakproof service since replacing steel tubing. Walker maintenance men keep a supply of Aeroquip Hose and Reusable Fittings on hand to replace tubing when needed.

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN

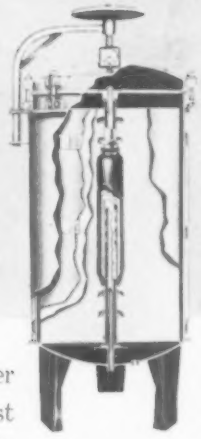
INDUSTRIAL DIVISION, VAN WERT, OHIO • WESTERN DIVISION, BURBANK, CALIFORNIA
AEROQUIP (CANADA) LTD., TORONTO 19, ONTARIO

AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

For Economy and Ease of Maintenance, Specify Aeroquip Reusable Fitting Hose Lines on New Equipment you Buy.

CFC HONAN-CRANE HYDRAULIC FILTER lowers operating costs on Injection Molding Presses

At Leaf Plastics, Inc., Yonkers, N. Y. this portable CFC Honan-Crane Bulk Type Filter purifies the hydraulic oil on nine injection molding presses.



Leaf Plastics, Inc., prolongs the life of their injection molding presses by reducing wear on precision fitted moving parts through the use of CFC Honan-Crane Hydraulic Filters. They enjoy definite dollar savings in reduced down time, maintenance and increased productive man-hours.

The CFC Honan-Crane Bulk Type Filter is used on each machine periodically. Oil is recirculated from the hydraulic sump through the filter to remove all harmful contaminants.

CFC Bulk Type Filters offer complete protection against contamination of practically all types of oils. Two filter media are available — cellulose for removal of suspended solids and Cranite (fuller's earth) for removing products of oxidation.

CFC Filters are engineered to your job requirements — for high filtration efficiency at low cost. For technical literature or engineering assistance, *write to Department FA*

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

For more facts Circle 498 on Reader Service Card
For more facts Circle 499 on Reader Service Card ➤

A NEW ERA IN RELAY LIFE AND RELIABILITY!

A-B QUALITY

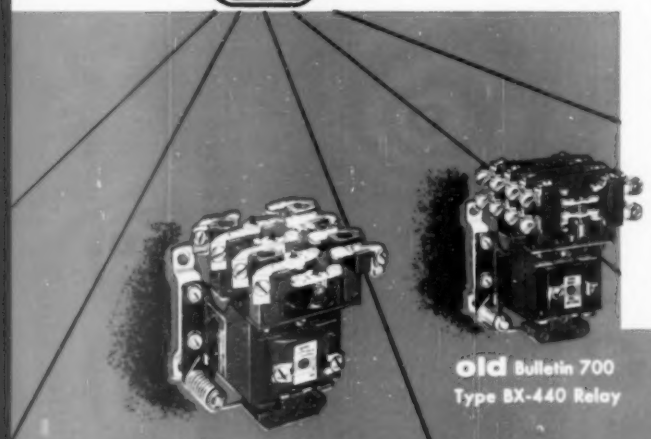
THEY MAY LOOK ALIKE, BUT

these new relays completely outmode the usual concepts of relay life and reliability.

For years the Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and their consistent, trouble free operation. In having produced millions of these relays, we learned how to improve them. Thus, the new line of Type B and Type BX relays was designed to set a new level of performance standards.

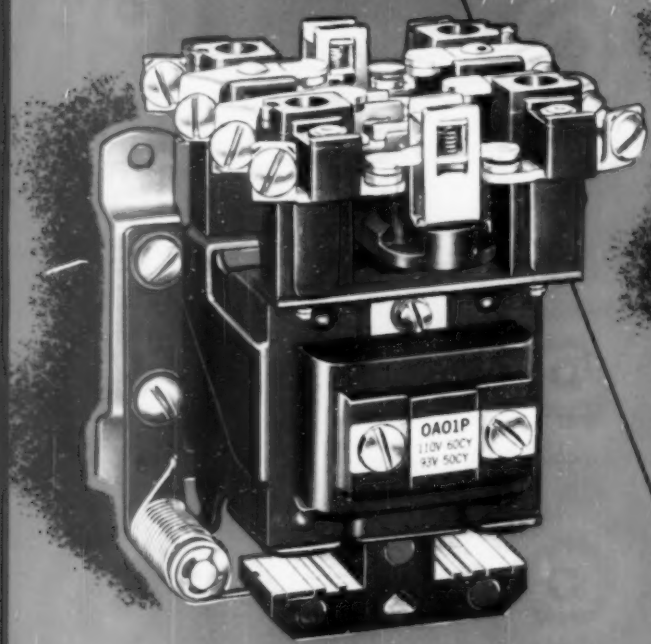
Turn the page and see the outstanding features of these new Bulletin 700 Type B and Type BX relays. For the same price, they offer you even greater value, greater reliability.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

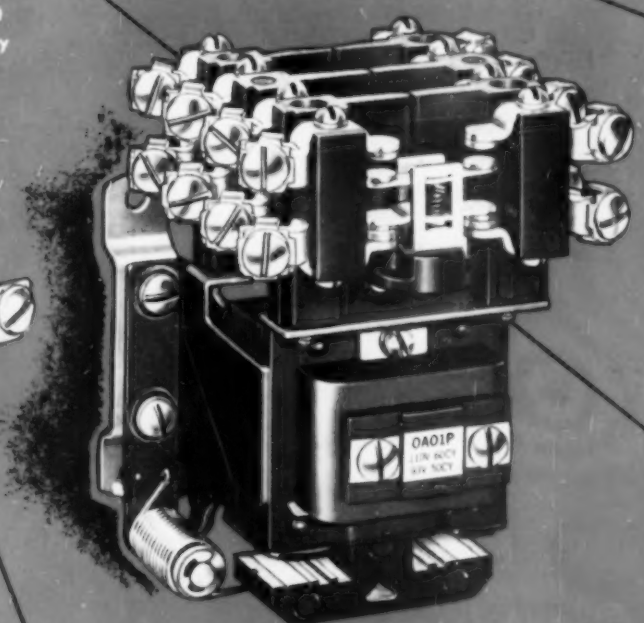


old Bulletin 700
Type B-400 Relay
with 4 N.O. contacts

old Bulletin 700
Type BX-440 Relay



new Bulletin 700, Type B-220A
AC Control Relay with 2 N.O. and 2 N.C. contacts



new Bulletin 700, Type BX-440A
AC Control Relay can be wired for normally open or normally closed contacts

ALLEN-BRADLEY
Member of NEMA
QUALITY MOTOR CONTROL

7-59-MR

NEW BULLETIN 700 RELAYS

TYPE B AND TYPE BX

provide these improved features

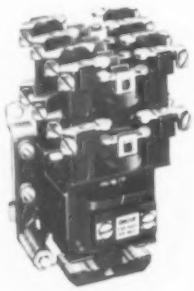
1. **New mechanical design gives *at least* 5 times greater operating life.**
2. **New contact motion provides 10 times greater electrical reliability.**
3. **Compact construction—new relays are structurally improved with no change in size.**
4. **Complete interchangeability. Mounting dimensions of new relays have not been changed.**
5. **Rugged, high efficiency cast plastic coil. New, improved coil fits *all* Bulletin 700 relays.**
6. **New, stronger, movable contact crossbar—fits Bulletin 700 relays now in service.**
7. **Improved stationary contact blocks. These new blocks can also be used on present models of the Bulletin 700 relay.**
8. **Increased life and reliability—*no increase in cost.* These new, improved relays are priced the same as previous Allen-Bradley models.**
9. **The letter A is added to the Bulletin 700 relay type number merely to distinguish the new line.**
10. **These new relays are Allen-Bradley's "thank you" to our many customers who have bought millions of Bulletin 700 relays over the years.**

A-B QUALITY

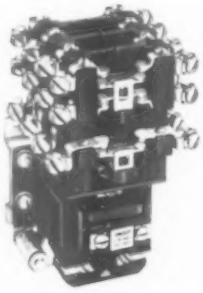
The old Bulletin 700 relay was first placed on the market some 25 years ago. Today, millions of these relays are in daily service—all over the world.

None of the old relay "values" have been lost in the new designs. Instead, these "values" have been greatly improved. The new relays feature a simplified, longer life, solenoid construction. The double break, silver alloy contacts are the same—always in perfect operating condition—without cleaning or filing. The operating coil has been greatly improved—it cannot be damaged by atmospheric conditions, no matter how severe.

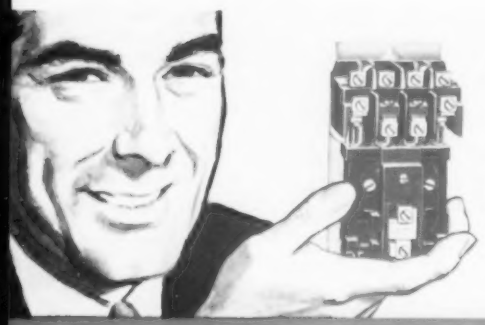
No one can deny the popularity of the older Bulletin 700 relays. The new relays—with their superior features—will be an even better answer for any and all relay applications.



TYPE B, GENERAL PURPOSE
Bulletin 700, 8-pole relay. Made with 8 N. O. and no N. C., or up to 4 N. O. and 4 N. C. contacts.



TYPE BX, UNIVERSAL
Bulletin 700, 8-pole relay with both N. O. and N. C. contacts. Changeover is made by reconnecting incoming lines.



HERE IS ANOTHER REMARKABLE ADDITION TO THE ALLEN-BRADLEY RELAY LINE

It's new . . . and it's different. This unusual Bulletin 700 convertible contact relay has contacts that can be changed from normally open to normally closed operation (or vice versa)—in just moments. A screwdriver is all it takes to do the job—no additional parts are needed. Like all A-B relays, it's good for millions of trouble free operations. Watch for announcement and full details of this new convertible relay soon!

ALLEN-BRADLEY

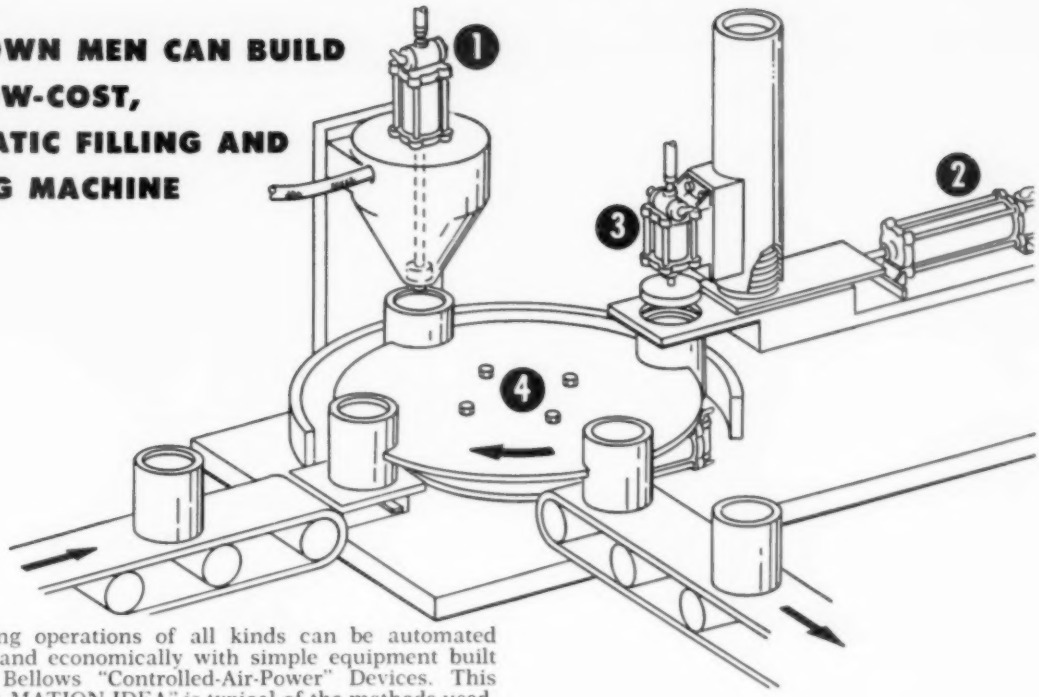
Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

7-59-MR

QUALITY MOTOR CONTROL

YOUR OWN MEN CAN BUILD THIS LOW-COST, AUTOMATIC FILLING AND CAPPING MACHINE



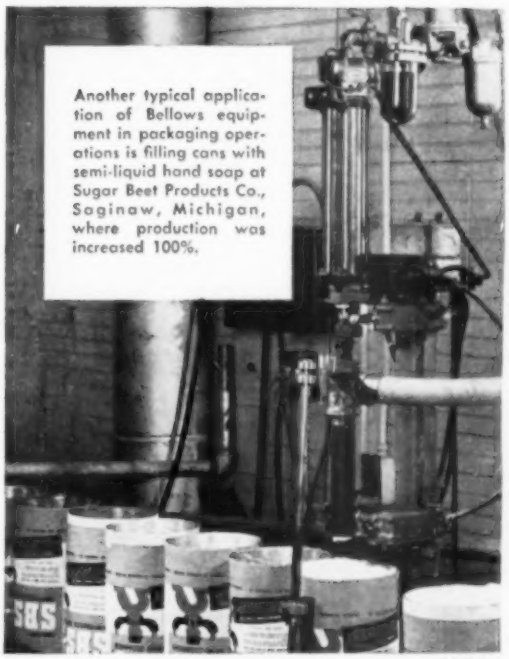
Packaging operations of all kinds can be automated quickly and economically with simple equipment built around Bellows "Controlled-Air-Power" Devices. This "SPOT-A-MATION IDEA" is typical of the methods used. Originally designed to fill and cap paint cans, it has been adapted to a variety of packaging operations. Bellows equipment has been used in packing and heat sealing plastic bags of sauerkraut, filling and capping glass pill bottles, and packaging granular material in paperboard containers, to cite a few examples.

In the sketch above, a belt conveyor feeds empty cans onto a Bellows Rotary Table equipped with a special top (#4), causing it to index through the work stations. After a container has been automatically positioned under the filling hopper, the piston rod of Bellows Air Motor #1 retracts, allowing paint to flow into the can. When a predetermined weight is reached, a limit switch is tripped and the piston rod advances to cut off the flow. At the next work station, Bellows Air Motors #2 and #3, operating alternately, deliver a lid to position and press it onto the can. At the last station, the filled and capped container is removed by a powered belt conveyor. All Bellows Air Motors are synchronized and electrically interlocked to assure proper timing and sequence of operations.

This is just one type of operation which Bellows Work Units can "spot-automate" simply and at low cost. Chances are there are scores of others in your plant. Why not investigate — *today*?

THIS SPOT-A-MATION IDEA FILE IS YOURS ON REQUEST

Contains installation data, wiring diagrams and equipment lists for the filling and capping machine as well as a score of other spot-automation applications of Bellows "Controlled-Air-Power" Devices. Write Dept. FA959, The Bellows Co., Akron 9, Ohio.



Another typical application of Bellows equipment in packaging operations is filling cans with semi-liquid hand soap at Sugar Beet Products Co., Saginaw, Michigan, where production was increased 100%.

1445-B

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

AKRON 9, OHIO

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

For more facts Circle 500 on Reader Service Card

Maintenance Cost Too High?

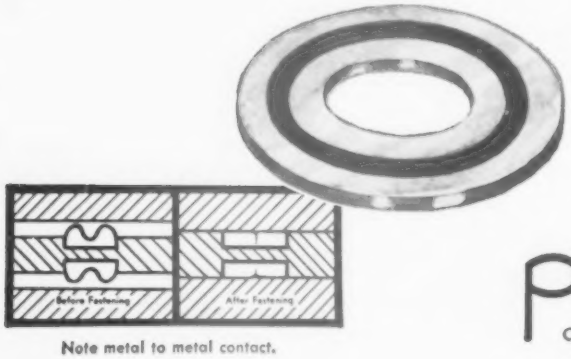
How much time, effort, and money is spent cleaning, resurfacing and/or replacing flanges to replace the seal!

Expensive? Yes!

Why not find out about Gask-O-Seals and save! Here are the facts: With Gask-O-Seal, flange faces require little or no cleaning or resurfacing of flanges when replacing the seal — *and Gask-O-Seals are re-usable.*

Gask-O-Seals save money and effort in many other ways, too. They are visually inspectable, do not need to be re-torqued, there is no material creep and they are non-directional, non-flexible, easy to install. They provide no-leakage sealing, *can not blow out,* and there is no wear due to pulse.

Now available to fit ASA standard flanges. Write for free catalog.



Note metal to metal contact.

Parker SEAL COMPANY

CULVER CITY, CALIFORNIA and CLEVELAND, OHIO

A DIVISION OF PARKER-HANNIFIN CORPORATION

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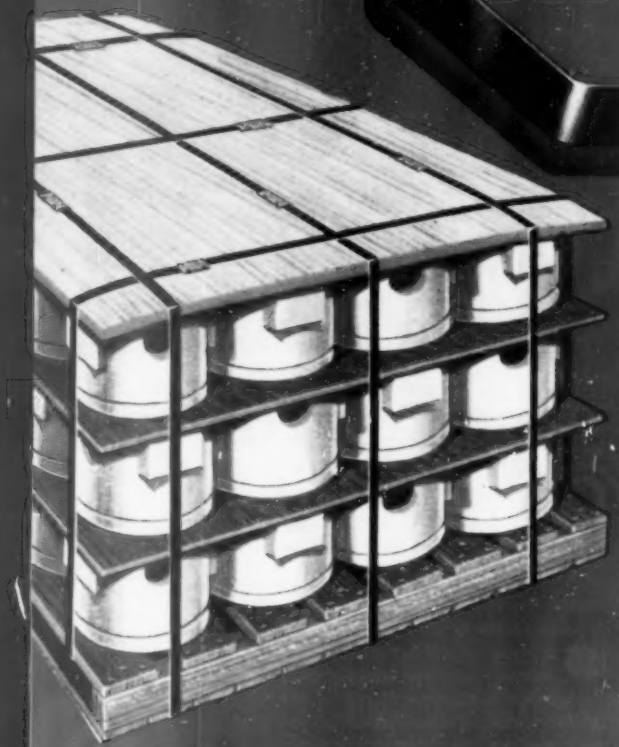
For more facts Circle 502 on Reader Service Card ➤

New Brainard HiFlex STRAP

Safe-Ty



New heavy duty strapping—
Lighter gauge—Just as strong—
More feet per pound—
More package conformity

After exhaustive testing in Sharon Steel laboratories, Brainard offers heavy duty strapping customers a new .031 cold-rolled strap to supplement its heavy duty strapping line. We call it "HiFlex"!

HiFlex features superior flexibility for better package conformity . . . gives more feet per pound . . . handles easier . . . faster. Now available along with .035 in ⅝" and 1¼" sizes.

This typical advance in heavy-duty strapping is why we continue to say, "Brainard is the strapping industry's most rapidly expanding line."

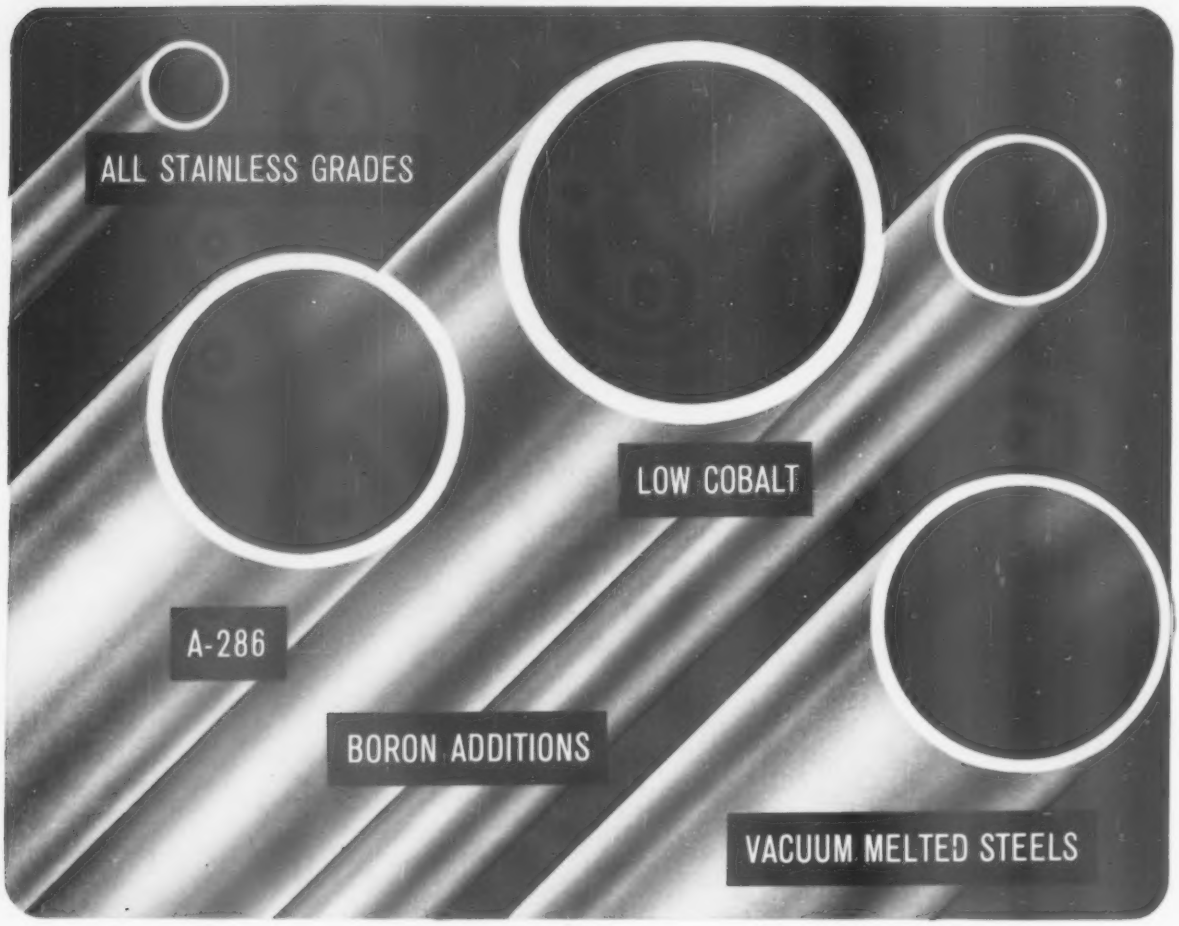
DIVISION OF SHARON STEEL CORP · WARREN, OHIO

BRAINARD Safe-Ty **STRAPPING**

In Canada: Brainard Steel, Canadian Division, Toronto, Montreal

MAKERS OF TENSIONAL, HEAVY DUTY STRAPPING, SEALS, ACCESSORIES, TOOLS FOR CARLOADING AND PACKAGING

Experience *— the added alloy in* **Allegheny Stainless**



What are your needs in Seamless Tubing?

A-L offers widest range of materials and large diameters with walls as thin as .032".

Here is the widest range in materials in stainless seamless tubing available anywhere to meet your exact requirements and solve high-temperature or corrosion problems and save you money.

Allegheny Ludlum makes seamless tubing in all stainless grades including 309, 317, 318, 310, 416 and 446—normally difficult to obtain. Also available in high-strength alloys such as A-286, in vacuum melted steels, and in custom analyses grades such as low cobalt with .01 or .05 max. and small boron additions to standard types.

A-L also makes composite tubes with bonded combinations of carbon and stainless and other metals for special chlorine-corrosion applications in process equipment.

Allegheny Ludlum Stainless Tubing ranges from $\frac{3}{16}$" OD to $3\frac{1}{2}$" OD with wall thickness ranging from .013" to .375"—typical of the sizes that A-L can produce. For certain applications, .500" walls are possible. Some standard sizes in stock are $2\frac{1}{2}$" OD—.032" walls, 3" OD—.042" walls and $3\frac{1}{2}$" OD—.042" walls and $3\frac{1}{2}$" OD—.058" walls. All sizes with true circularity, no dents or handling marks.

A-L Tubing is also available in small quantity orders, in random or cut lengths. Standard grades and sizes in stock throughout the country. Call your nearest A-L representative for all the help you need.

Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa. Address Dept. F-21.

NEW! FREE—Write for your copy of Allegheny Ludlum Stainless Tubing—32-pages of technical data, grades and suggested applications.

WSW 7828

ALLEGHENY LUDLUM

for warehouse delivery of Allegheny Stainless, call RYERSON

Export distribution: AIRCO INTERNATIONAL

EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT

For more facts Circle 503 on Reader Service Card

For more facts Circle 504 on Reader Service Card ➤

Newly designed
Type H Motor Control

Ultimate in protection

for men and machines

Here's the last word in control protection for personnel and equipment! It's all part of Allis-Chalmers newly designed, high voltage control.

And maximum protection is only one of the features of this new control line. You also get full-front access, smaller cabinet size (2.36 square feet less than competitive units), a completely tested unit, and ample panel space for optional features.

1. Gang-operated disconnect switch isolates starter from incoming power—assures safe entry to high voltage compartments.

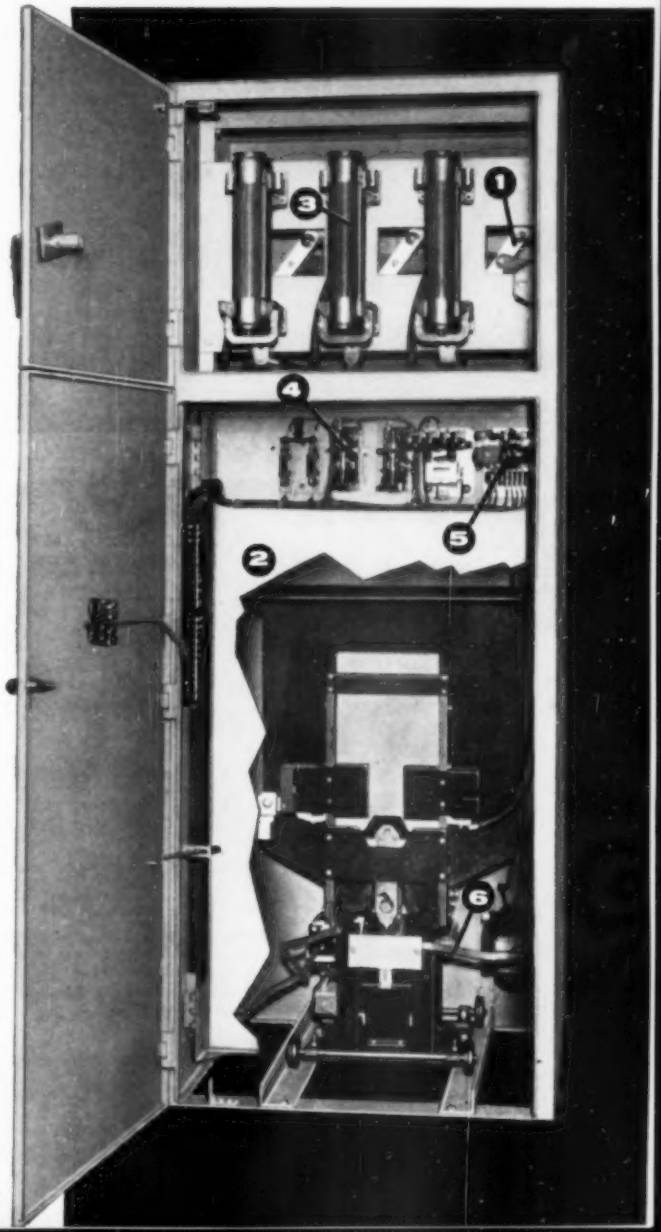
2. Steel cubicle separates high and low voltage equipment.

3. Short-circuit protection provided by fast-acting current-limiting fuses, rated 150,000 kva at 2300 volts and 250,000 kva at 4160 or 4600 volts.

4. Overload protection provided by accurate temperature-compensated thermal overload relays which trip only with excessive motor current, preventing needless motor stoppages.

5. Undervoltage protection instantaneously opens line contactor on loss of voltage. Time-delay undervoltage protection also available.

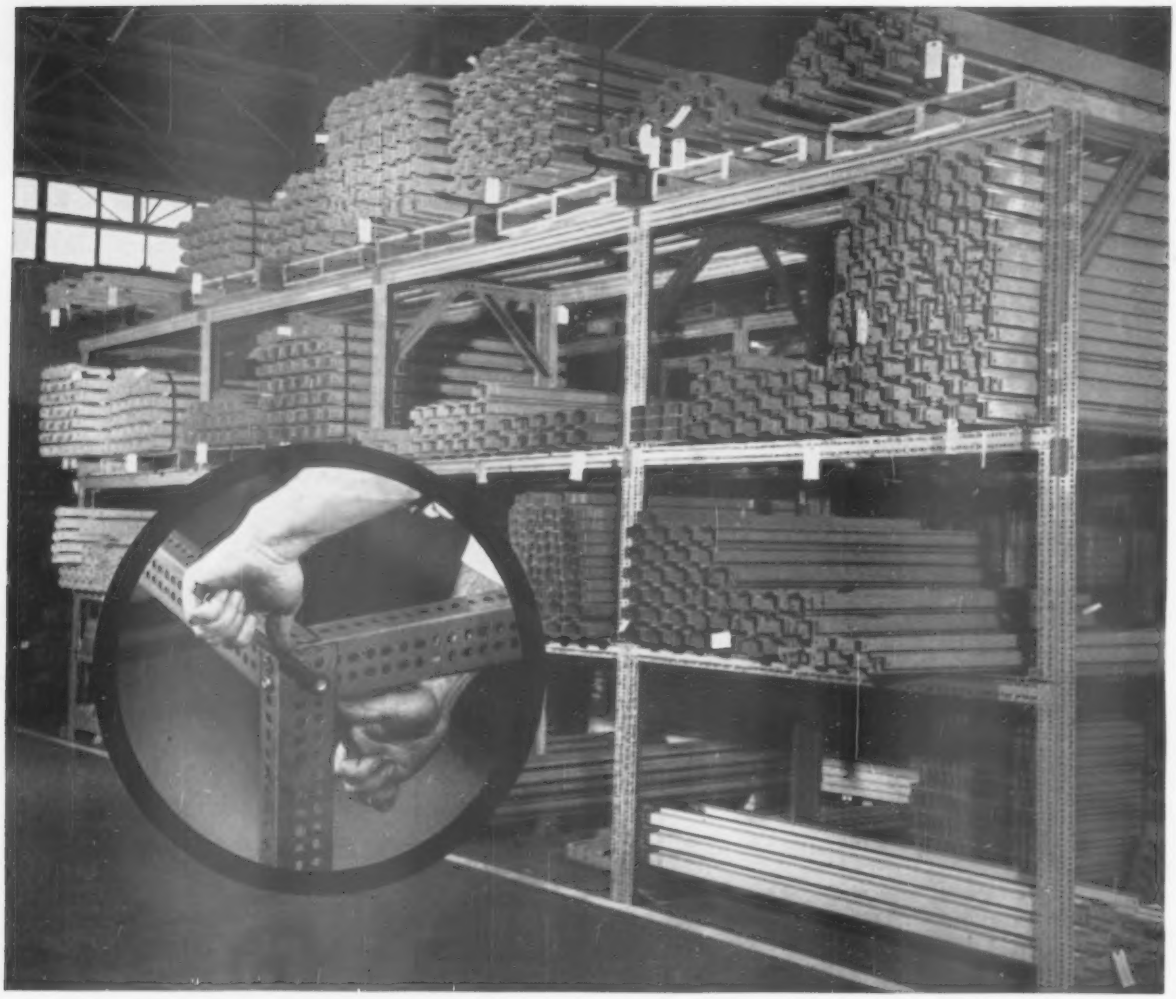
6. Mechanical interlock coordinates contactor, disconnect switch, outer door and inner control barrier for maximum safety.

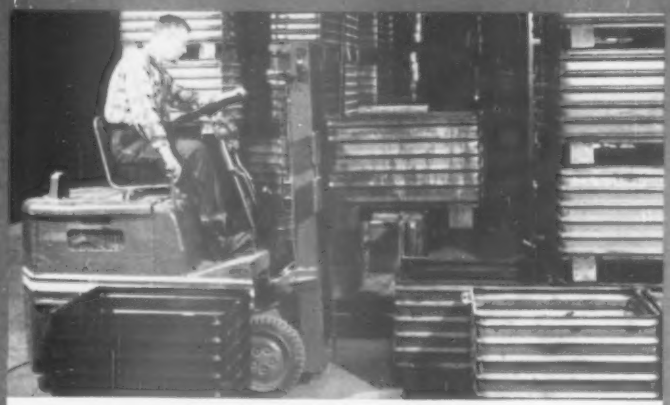


This starter line meets every 2300 to 5000-volt motor need. Contact your A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

ALLIS-CHALMERS A-C

A-5521





REPUBLIC MATERIALS HANDLING EQUIPMENT saves time at Signode Steel Strapping Company, Glenview, Illinois. At Signode, Republic Stacking Boxes are filled with finished parts, stacked high for production assembly or shipment. Stacking does not damage the boxes. Heavy-duty stacking brackets and corrugated box construction deliver long, efficient service at low per-year cost. Send for information.

REPUBLIC STEEL PALLET RACKS save space, simplify palletizing, stacking of bulky, uneven, odd-lot, and fragile materials. Tubular steel supports adjust every six inches to handle material to any height. Two-way entry permits loading and unloading from either side. Write today.

For more facts Circle Reader Service Card numbers as follows:

Republic METAL LUMBER

..."imagineering" in steel framing assemblies

Republic METAL LUMBER® is the answer to erecting fast, economical, framing assemblies. It is as easy to use as common lumber. Yet, stronger . . . because it is heavy gage steel.

METAL LUMBER is engineered with a scientifically designed pattern of slots arranged on ¼" centers. Even complicated framing problems are easy because this unique system of short longitudinal and transverse slots makes possible an unlimited number of straight and angular assembly combinations.

METAL LUMBER is ideal for erecting storage racks, work benches, catwalks, ramps, ladders, and other framing assemblies tailored to your particular needs.

METAL LUMBER is fabricated at Republic's Berger Division. Made of heavy gage steel for maximum strength and rigidity. Bonderized after fabrication. Finished in gray baked-on enamel. Available in packages of convenient lengths, and in two heavy gages. Delivered complete with bolts and nuts for assembly.

METAL LUMBER is never obsolete. Its cut-and-join simplicity makes quick assembly possible with unskilled labor. When one setup is no longer needed, it can be torn down and converted into a new and useful unit. No scrap loss—even the smallest piece can be used as a cleat or splice.

Republic METAL LUMBER provides complete flexibility for your "imagineering." Simply plan, cut, and assemble. An attractive 20-page brochure tells you how.

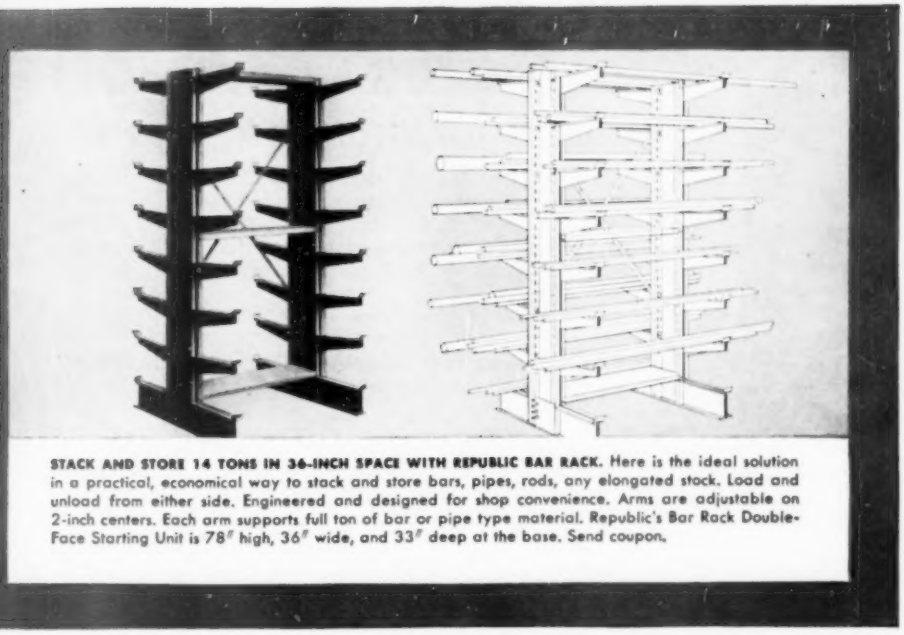
CALL YOUR REPUBLIC REPRESENTATIVE, OR WRITE...

REPUBLIC STEEL CORPORATION
DEPT.FA-8163
1440 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send information on the following Republic products:
☐ Republic METAL LUMBER brochure ☐ Republic Steel Pallets
☐ Materials Handling Equipment ☐ Republic Bar Rack
☐ Have a Republic-Berger Materials Handling Engineer call

Name _____ Title _____
Company _____
Address _____
City _____ Zone ____ State ____

REPUBLIC STEEL
World's Widest Range of Standard Steels and Steel Products



STACK AND STORE 14 TONS IN 36-INCH SPACE WITH REPUBLIC BAR RACK. Here is the ideal solution in a practical, economical way to stack and store bars, pipes, rods, any elongated stock. Load and unload from either side. Engineered and designed for shop convenience. Arms are adjustable on 2-inch centers. Each arm supports full ton of bar or pipe type material. Republic's Bar Rack Double-Face Starting Unit is 78" high, 36" wide, and 33" deep at the base. Send coupon.

505 Metal Lumber, 506 Materials Handling Equipment, 507 Steel Pallets, 508 Bar Rack.

CRANE WITH ROTATING TROLLEY SPEEDS WAREHOUSE HANDLING

Storage area for tubing used in the production of tapered roller bearings at The Timken Roller Bearing Company, Bucyrus, Ohio. A Cleveland Tramrail double-girder completely motorized crane handles the material in and out of storage and to the machine tools. The crane can travel the entire length of the department and the trolley will rotate 360 degrees, enabling the operator to turn full bundles into position required for loading machine racks.

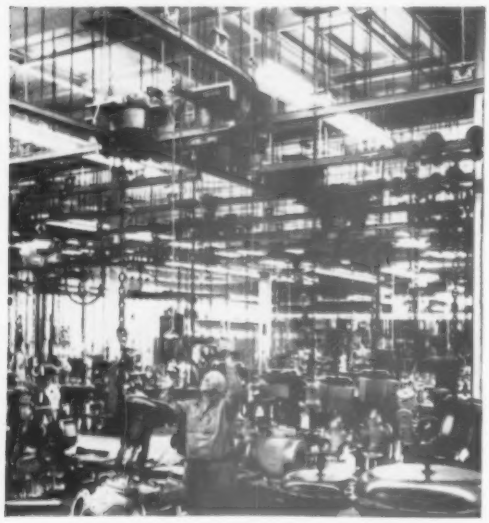
CLEVELAND TRAMRAIL USED IN MANY WAYS TO PRODUCE IMPORTANT SAVINGS

TRAMRAIL SYSTEM HANDLES VALVES THROUGH VARIOUS STEPS OF MANUFACTURE

Provides 80% Floor Space Savings

This is not a blurred picture. What makes it appear so is the vast number of chains suspended from hundreds of Cleveland Tramrail carriers which are used at the Mason-Neilan Division, Worthington Corporation, Norwood, Massachusetts, to carry valves through the various steps of manufacture. The entire system of production is dependent upon the performance of the overhead Tramrail.

A very important advantage of the Tramrail system is the large savings in floor space it makes possible. If floor type handling equipment were used, it has been estimated that about five times as much floor space would have been required.



TRAMRAIL TRACK LOOP CUTS CLEANING AND PLATING COSTS

This Cleveland Tramrail track loop at the Duro Fittings Co., Los Angeles, California, is a big factor in cutting costs and speeding parts between cleaning and plating operations. Two hand-operated carriers with electric hoists serve this work at high efficiency.

WRITE FOR FREE COPY of Engineering and Data Booklet No. 2008. Packed with valuable information. Profusely illustrated.

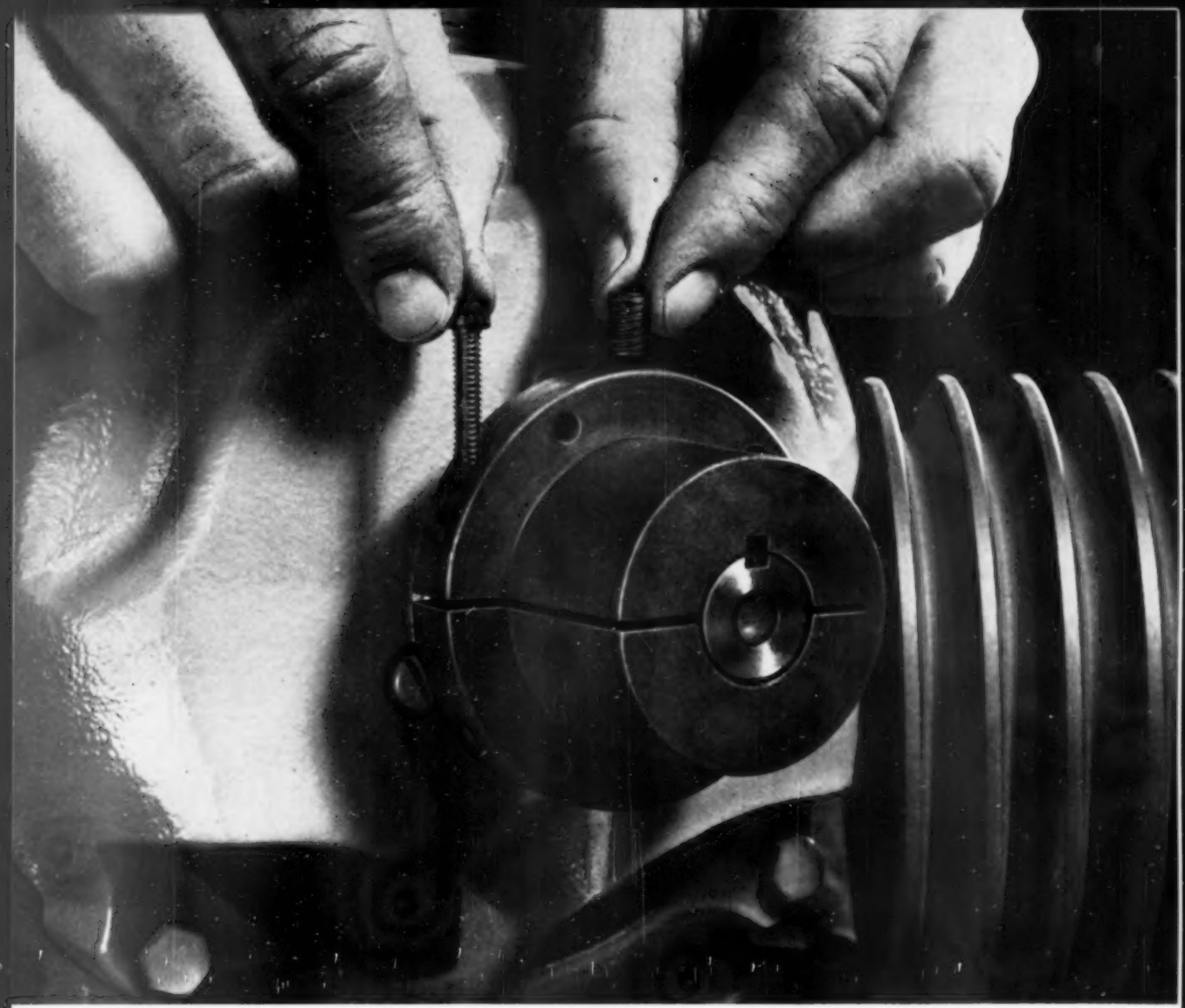
CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 3248 E. 290 ST. • WICKLIFFE, OHIO

For more facts circle 510 on Reader Service Card

See LOCAL SOURCES Section This Issue



Announcing Worthington QD Sheaves with the

GOLDEN SCREWS

To demonstrate to you that the exclusive two-screw design is practically worth its weight in gold, all Worthington QD (Quick Detachable) sheaves now have two golden screws.

The clamp screw simplifies installation and assures permanent alignment. You can install QD sheaves one part at a time. No heavy rim and hub combination to delicately inch into place. You just slide the hub on the shaft and permanently lock it in position with the clamp screw. Then you slide the sheave rim into position on the hub. This job is simplified because you engage the large end of the sheave with the small end of the hub. To change speed you simply install another sheave on the hub which remains anchored to the shaft by the clamp screw.

The set screw prevents "key drift." It locks the key securely in place, avoiding the danger of the key drifting off and becoming a safety hazard. This feature is appreciated by plant operators who first brought this potential danger to Worthington's attention.

You tighten the set screw without distorting the hub. The clamp screw allows you to locate the hub on the shaft. The locked hub then permits you to tighten set screw on key without distortion.

You can get Worthington QD sheaves anywhere in the U.S. More than 350 distributors carry Worthington sheaves and Worthington-Goodyear Green Seal V-belts. For your copy of a 100-page Multi-V-Drive Manual on how to select the right sheave and V-belt write to Worthington Corporation, Section 79-15, Oil City, Pennsylvania. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

For more facts Circle 511 on Reader Service Card

SAFEGUARDS ITS PROPERTY WITH ADT *Automatic* PROTECTION

Selected by FACTORY magazine as one of the nation's Top Ten for 1959, the new Cutler-Hammer low-voltage distribution apparatus plant is a model of clean building lines and uncluttered working space—with plenty of growing room.

Automatic operations within the 300,000 square-foot plant are used wherever possible, even to safeguards against fire and intrusion.

ADT Sprinkler Supervisory and Waterflow Alarm Service maintains a continuous, automatic check on water supply to the sprinklers and will automatically summon fire fighters in case of fire. In unsprinklered plant areas, ADT Aero Automatic Fire Alarm Service will automatically detect and report a fire in those vital first few minutes. Failure of Cutler-Hammer watchmen to signal while on patrol will result in prompt investigation.

ADT SERVICE CAN HELP YOU, TOO...

Whether your project is old or new, sprinklered or unsprinklered, there is an appropriate ADT Automatic Protection Service to meet every requirement. An ADT specialist will show you how combinations of *automatic* services can safeguard property, profits, and employees' jobs, at lower cost than other, less effective methods. Call the ADT sales office listed in your phone book; or write to our Executive Office.

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Executive Office: 155 Sixth Avenue, New York 13, N. Y.

A NATIONWIDE ORGANIZATION

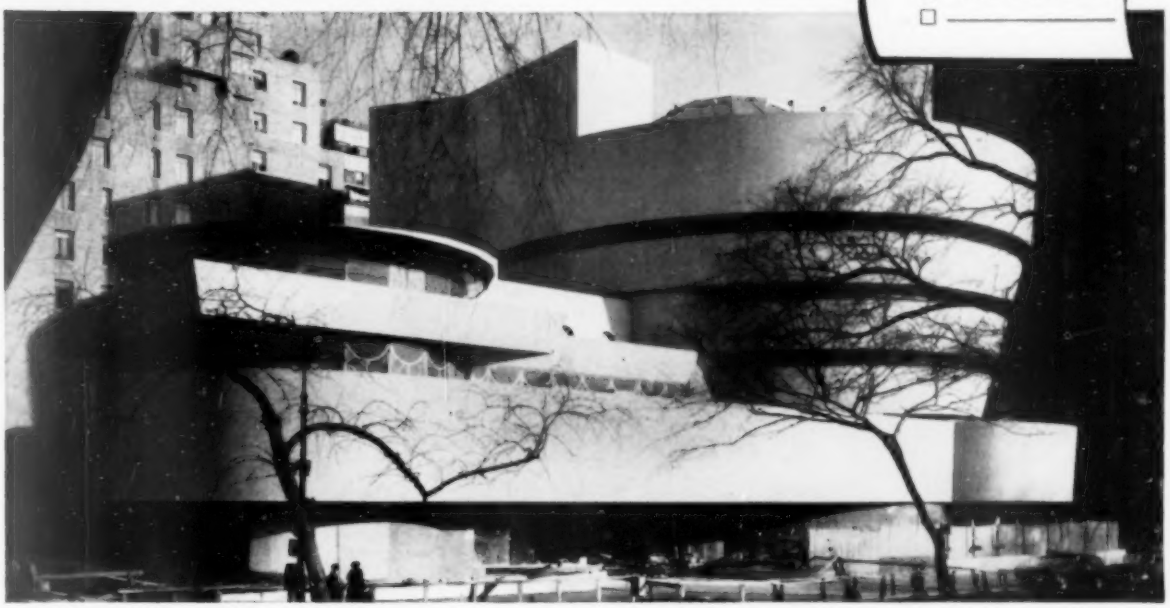
ADT

A REPORT TO MANAGEMENT ON HOW

Industry cuts costs with FIR PLYWOOD

ROUTE TO:

- ☐ ENGINEERING
- ☐ PRODUCTION
- ☐ SALES
- ☐ PURCHASING
- ☐ MAINTENANCE
- ☐ CONSTRUCTION
- ☐ _____



Over seas with safety-plus go home furnishings in huge fir plywood "Sea Pak" containers developed by Lyon Van Lines, world-wide movers. Exterior fir plywood was chosen to replace aluminum after passing rigorous impact and weathering tests.

Curves create problems for concrete contractors—but fir plywood forms help provide the solution. Nowhere is this better demonstrated than on the new Solomon E. Guggenheim Museum, New York City, designed by Frank Lloyd Wright and built by the Euclid Contracting Corp. Job superintendent Charles Spero reports, "This job could not have been done without fir plywood concrete forms."

Light-weight protection for tractor and motor grader parts is afforded by these inexpensive fir plywood separator trays. Allis Chalmers Manufacturing Company currently uses about 12,000 in its Springfield, Ill. plant, and has used them for the past five years. They speed inventory and handling, protect parts in transit.

FOR MORE INFORMATION about fir plywood—its uses, properties and advantages—write

DOUGLAS FIR PLYWOOD ASSOCIATION

TACOMA 2, WASHINGTON

—an industry-wide organization devoted to research, promotion and quality control

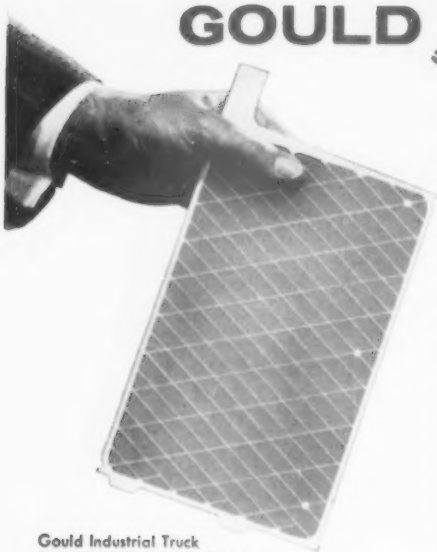
Always specify by DFPA grade-trademarks

DFPA TESTED QUALITY

For more facts Circle 513 on Reader Service Card

25% MORE BATTERY LIFE FREE!

WITH THE NEW GOULD *SILCONIC* PLATE



Gould Industrial Truck Batteries with Silconic Plates resist corrosion, hold their charge and last longer.

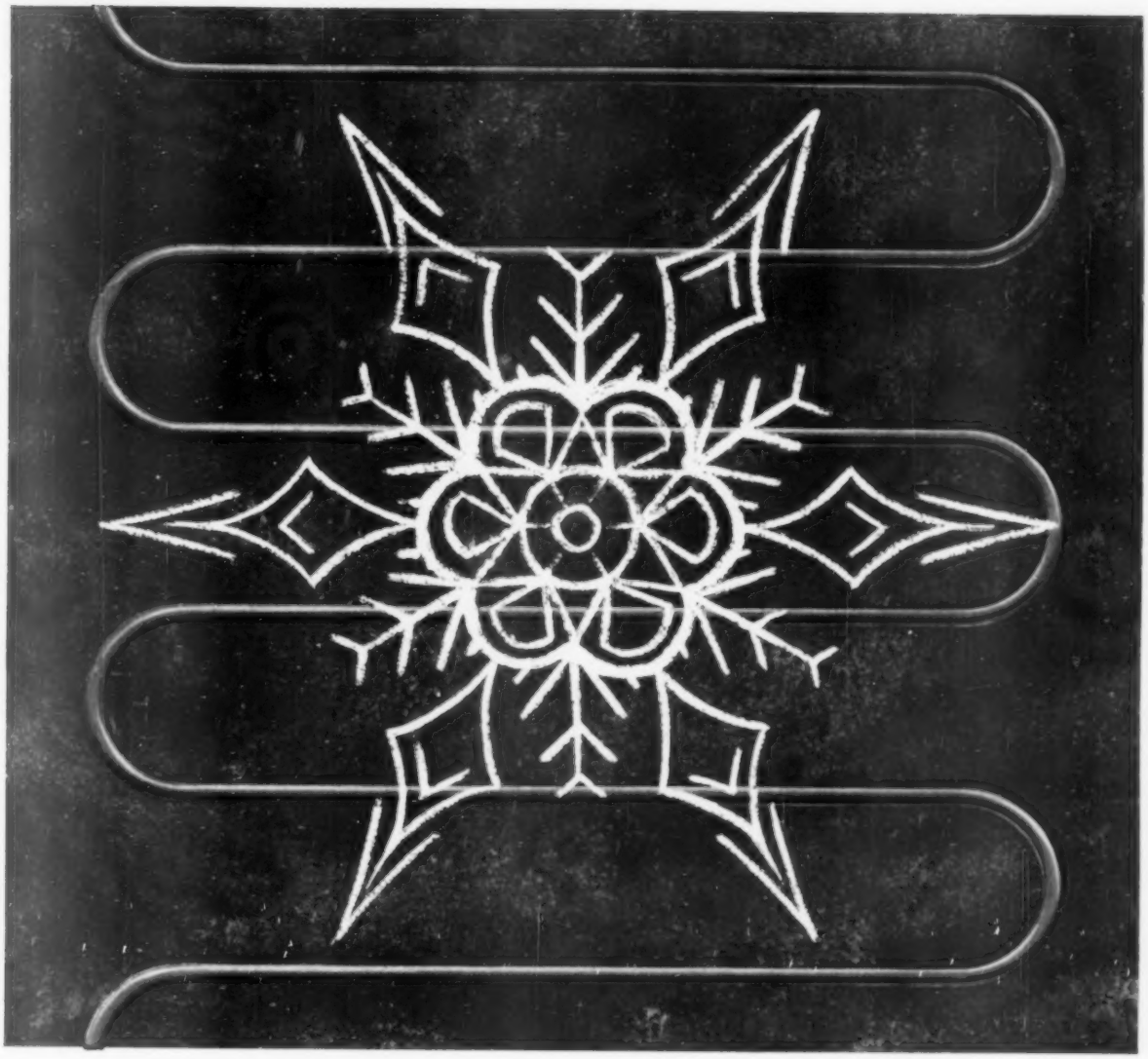
Used on all motive power batteries, the Silconic Plate prevents grid corrosion, the most common cause of battery failure. Here's the principle: Gould introduces silver and cobalt into active materials of the positive plates. Silver and cobalt migrate to—and collect on—positive grid members, forming an insoluble oxide surface impervious to acid and oxygen attack. The longer the battery operates, the deeper the silver-cobalt penetrates into the grid metal, thus prolonging life. In applications where batteries are idle for periods of time, Gould's Silconic Plate prevents migration of materials to the negative plate, effectively reducing self-discharge within the cell.

For greater overall strength, arsenic is added to the antimonial alloy of the plate, resulting in an extremely dense, homogeneous grid *free of flaws*. This vital new physical and chemical strength—together with Gould's compact battery design—add up to the most advanced motive power battery you can buy. Write today or call your local Gould representative. He's listed under "Batteries Industrial" in the yellow pages. Gould-National Batteries, Inc., Trenton 7, N. J.

More Power to you from **gould**

For more facts Circle 514 on Reader Service Card

See LOCAL SOURCES Section This Issue



This snowflake never had a chance

. . . to cause trouble. A SPANGRID Steel Pipe snow-melting system under the paving where he landed turned him to water . . . fast!

A WHOLE SKY-FULL OF SNOWFLAKES won't bother you this winter if you have a SPANGRID Steel Pipe snow-melting system at work for you. You'll save time and material costs for snow removal . . . loading docks, drives and walks will be open all year long . . . and you'll eliminate a safety hazard, too!

COLD FACTS ON A HOT SUBJECT are contained in a booklet called "Snow Melting Systems" which we'll be glad to send you. It covers installation, operation and costs of a steel pipe snow-melting system. Write us for a copy. No obligation.

PLAY IT COOL now while the weather's good. Talk with your local contractor about installing a snow-melting system. And when you give him the go-ahead, tell him to use SPANGRID Steel Pipe, because SPANGRID will give you years and years of trouble-free service.

SPANGRID* STEEL PIPE

SPANS CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

Announcement of Major Significance

FOR EVERY USER OF SOCKET HEAD CAP SCREWS

Following exhaustive studies begun in 1954, the socket screw products industry adopted, on April 24, 1959, new dimensional standards for socket head cap screws. Standard Screw Company participated in these studies and concurred in the recommendations approved by leading fastener manufacturers.

Adoption of the new standards, to be known as the "1960 Series", has important implications for every user of socket screws. As a public service Stanscrew will point out these implications . . . not only in relation to its own products, but also to the overall program of the industry.

Differences, Advantages Of New Design

The "1960 Series" has been carefully engineered so there is functional uniformity for all sizes, particularly as it applies to wrenching areas and to the relationship of head diameters to body diameters. For most sizes, as illustrated, this means substantial increases in both head diameter and socket size, and thus provides these advantages over the present design:

1. *Maximum utilization of the fastener's inherent strength . . . larger wrenching area permits application of greater clamping force.*
2. *Increased bearing surface under the head . . . up to 233% more.*
3. *Minimum indentation . . . particularly important with softer metals.*

Should You Convert Now?

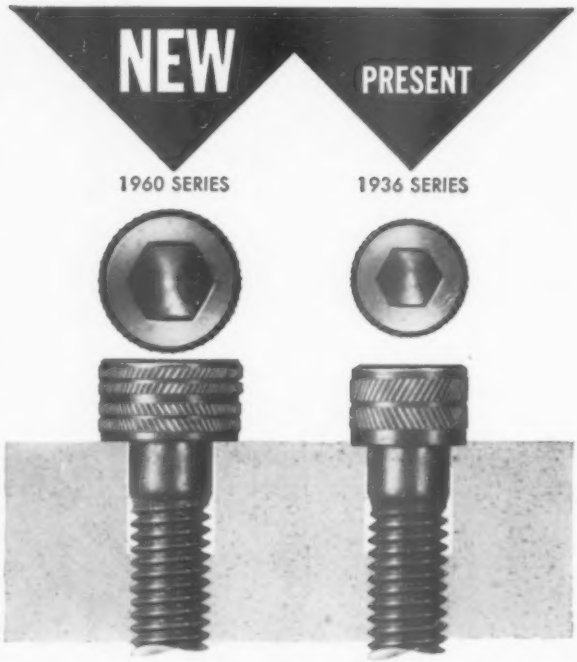
Obviously, for many applications, the new design offers important benefits which indicate conversion as rapidly as possible. In some cases, however, existing product design may not accommodate the larger heads . . . or, where socket cap screws are countersunk, revising your countersinking operations may create significant production problems. Stanscrew urges, therefore, that each company learn complete facts on the fastener industry's future plans.

Timetable For Industry Changeover

Stanscrew has already started production of the new "1960 Series". Manufacture of the present (1936) series will continue, however, and they will be available as standard, in-stock items until at least January 1, 1961. At that time, it is now contemplated the "1960 Series" will become the accepted standard throughout industry and the "1936 Series" will then be furnished only when specifically ordered.

When Designing A New Model

For products now on the drawing board, this timetable indicates many manufacturers should plan to use the "1960 Series" as the standard for later production. By making such design provisions, you assure maximum acceptance and minimum difficulty in the future.



For Existing Products

For many existing applications, where socket cap screws are not countersunk, either the 1936 or the "1960 Series" may be used. In frequent cases, improvements of the 1960 design suggest conversion within a short period. In other applications, where the heads are countersunk or where the greater head diameters of the "1960 Series" create a problem, changeover should probably be postponed until a general redesign of your product is scheduled.

Special Stanscrew Marking

To further distinguish its "1960 Series", Stanscrew will knurl heads of all new style socket cap screws with a split herringbone design (as shown). This special marking and the new "1960 Series" box labeling will provide quick identification of these quality fasteners.

For Further Information

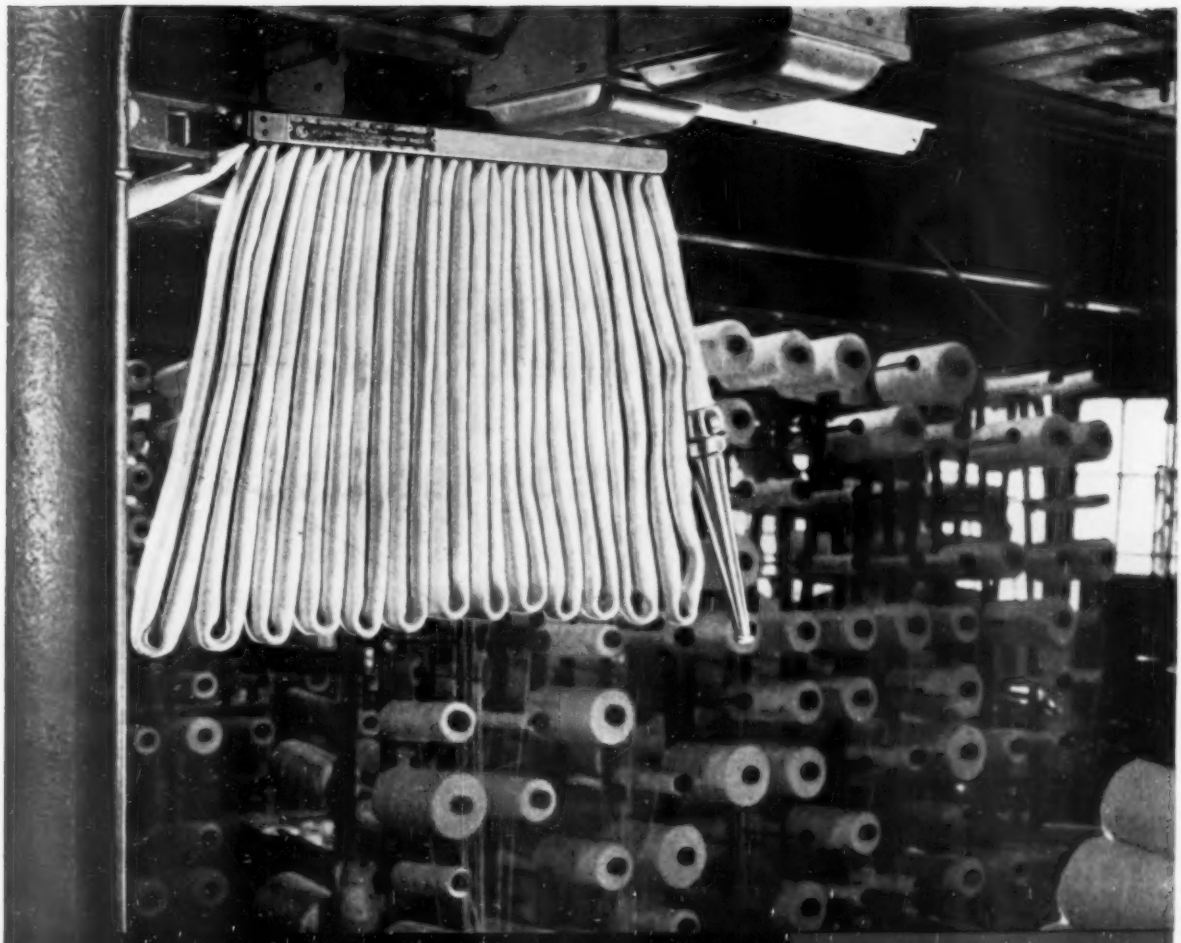
Your Stanscrew distributor has the latest facts on the new "1960 Series" and will be happy to discuss them with you. If desired, he also will arrange for a prompt visit from a Stanscrew fastener specialist who will be most happy to go over all aspects of this new industry program as it regards your own particular operation.

Stanscrew also has a new brochure which provides complete dimensional and design data on the "1960 Series". No obligation, of course, for your copy.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

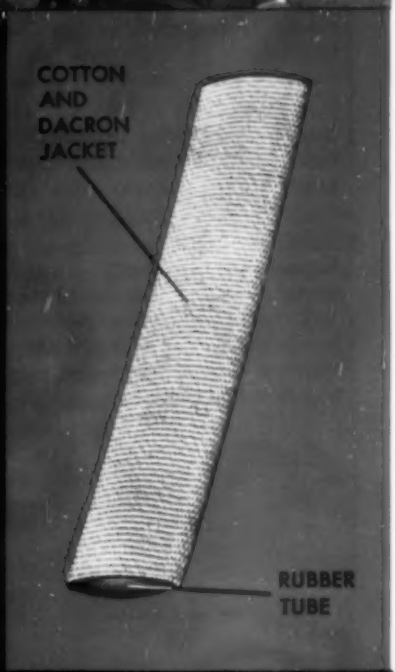


Is your hose ready to fight a fire today?

Acme-Hamilton's Eze-Pak is always ready and dependable. This hose is specifically built to be folded flat and reeled flat. Will store on all types of racks and reels. Eze-Pak Fire Hose will deliver all the water to the fire—it won't leak to damage costly material and equipment.

FACTORY MUTUAL APPROVED EZE-PAK Fire Hose was developed to meet the needs of industrial fire protection. The rubber tube is loose at the points of fold to prevent cracking. The single jacket of cotton and Dacron* is lightweight, durable and very flexible. 1½" size available in 50, 75 and 100 ft. lengths. Leakproof, easily dried. Write Acme-Hamilton, Dept. M for information.

* Dupont Trade Name



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ANNOUNCING

expanded, nation-wide service on

ALUMINUM

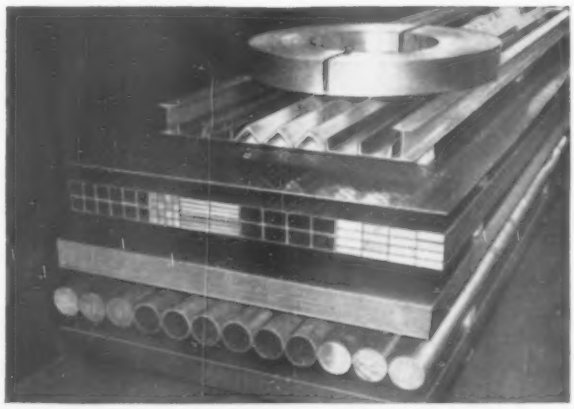
from Ryerson stocks

Here are two important new developments in Ryerson service on Reynolds aluminum. First, stocks are now available from our plants coast to coast. Second, a much broader range of sizes and types are now on hand—and aluminum building products have also been added. Here's what this expanded service offers you:

Widest selection—Stocks include rod and bar, plate, flat and coiled sheet, tubing, pipe, and structural and extruded shapes in a complete range of alloys, tempers and sizes. Also available for quick shipment: building products, including corrugated and V-beam roofing and siding, ribbed embossed siding, roof deck and insulated wall system. Non-standard or "hard-to-get" items are no problem—we can supply *all* your needs.

Unequaled cutting facilities—Ryerson equipment includes latest mill-type slitters, cut-to-length lines, shears, saws and abrasive disc cutters—facilities that save you time and money.

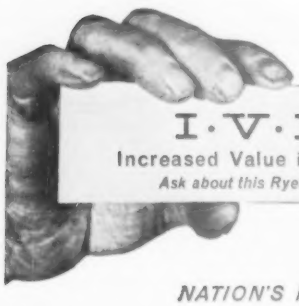
Expert technical help—Your Ryerson Representative is well qualified to serve you. Backed by a staff of experienced aluminum specialists, he is ready to help with any problems involving the selection and fabrication of various aluminum alloys.



All types, shapes and sizes of aluminum ready for immediate shipment from expanded Ryerson stocks—including building products,

Fast, dependable delivery—The nation's most complete service centers, in principal cities coast to coast, assure dependable delivery as promised—in a matter of hours if needed.

Whatever your aluminum requirements—whatever your selection and fabrication problems—*call Ryerson.* You'll get prompt, personal service on *aluminum* as well as *steel.*



I·V·B·M
Increased Value in Buying Metals
Ask about this Ryerson Plan for 1959

RYERSON CERTIFIED QUALITY

RYERSON STEEL®
Member of the INLAND Steel Family

STEEL • ALUMINUM • PLASTICS • METALWORKING MACHINERY

NATION'S MOST COMPLETE SERVICE CENTERS IN PRINCIPAL CITIES COAST TO COAST

For more facts Circle 518 on Reader Service Card

FACTORY . . . PRESS TIME REPORT • SEPTEMBER 1959

Looking Ahead in Business

You'll begin to see evidence of the steel strike in government figures on business activity. The Index of Industrial Production for July, for example, slipped back two points to 153.

The first two weeks of the steel strike thus put a halt to more than a year of steady growth in industrial output. The Index for August is likely to show a further decline.

Reflecting the idleness of steel workers, wage and salary payments for July dropped slightly. Even so, total personal income continued to grow. It hit an annual rate of more than $384-billion in July, against $363-billion in July a year ago.

•

One factor in the continued growth of personal income is the steady growth of dividend payments.

In spite of the recession last year, dividends to stockholders held up pretty well. This year payments have improved substantially. In July they reached an annual rate of more than $13-billion—up almost 10% from last year. Indications are that even further improvements are in store.

Reports of quarterly income of leading corporations for the second quarter of this year show substantial increases in profits over the first three months.

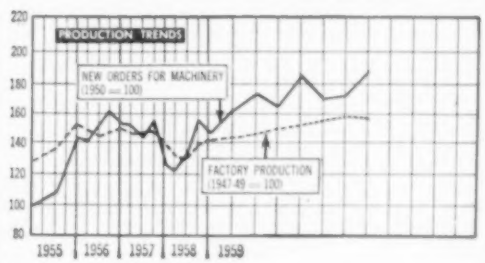
Profits of manufacturing corporations as a group for the first half of this year will be about 60% above the same period last year. Companies will thus be in position to increase dividends in the months ahead. And dividend payments will boost personal income.

•

One reason for improved profits now being recorded by manufacturers is the sharp increase in sales over the past year.

By June of this year manufacturers' sales were running $5-billion a month above the corresponding 1958 level. Sales of durables alone were more than $3-billion over last June. And sales of manufactured products are likely to stay at a high level in the months ahead.

FACTORY FIGURES OF THE MONTH



Indicator	July 1959[p]	June 1959[r]	July 1958
New Orders for Machinery (exc. elec.)[1]	188.0	173.0	163.0
Contracts for Industrial Construction[2]	143.0	142.0	89.0
Factory Production[3]	157.0	158.0	136.0
Consumers' Prices (cost of living)[4]	124.8	124.5	123.9
Industrial Prices (materials, supplies)[4]	123.4	128.2	125.6
Manufacturing Employment (millions)[5]	16.4	16.4	15.2
Total Employment (millions)[5]	67.6	67.3	65.2
Unemployment (millions)[5]	3.7	4.0	5.3

[p] = preliminary [r] = revised

Sources: 1. McGraw-Hill Department of Economics (1950 = 100); 2. Engineering News-Record (1950 = 100); 3. Federal Reserve Board (1947-49 = 100); 4. U. S. Department of Labor, Bureau of Labor Statistics (1947-49 = 100); 5. U. S. Department of Labor, Bureau of Labor Statistics.

Manufacturers' new orders are the key to sales. New orders have been rising recently. Like sales, they are more than $5-billion ahead of last-year levels.

The high level of output in recent months means many producers are beginning to push beyond their preferred operating rates. The average operating rate of manufacturing companies jumped from 70% in April 1958 to over 85% this June.

Some manufacturers have already announced plans to expand. Others may do so under pressure of current operating rates. Capital spending plans will thus continue upward.

•

The rising cost of borrowing will handicap some businessmen who want to expand. But most of them can count on increased income to cover much of the spending for more capacity. Depreciation funds will help cover costs of modernization.

Ideas of the Month

(For more information, circle item numbers on Reader Service Card next to back cover)

Previewer-8 is a natural for training departments, being a handy-dandy pocket viewer (*Hudson*) for 8mm movie film, in color or black and white. Takes standard 50-ft. reel. Loads in 15 sec. You turn crank to run it. **(311)**

For those who'd like to, or ought to, dig into the "care and feeding" of industrial batteries, there's a 36-page booklet (*Gould*) telling all. **(312)**

If you're looking for better ways to control production, maintenance, inventories, try a brochure (*Graphic Systems*) that contains 25 tested ideas. It's part of a free visual control planning kit. **(313)**

Budding young authors of technical papers, articles (for FACTORY, mebbe), or books shouldn't write a line before consulting a new standard (*ASA-ASME*) that shows how to prepare graphs, line drawings, tables, etc. **(314)**

Handling corrosives? Can't go wrong with a slide chart (*Hoke*) that shows resistance (substantial, moderate, questionable, inadequate) of a score (count 'em) of construction materials to 247 (count 'em) different types. **(315)**

Locolite is a slick locator light (*Black & Webster*) for machine tools. Only 3½ in. long, it pinpoints work area with beam of light. **(316)**

Calking compound (*West Chester Chemical*) comes in fast colors—pink, blue, yellow, green, etc.—is based on Du Pont Hypalon (chlorosulfonated polyethylene), cures into a resilient, won't get hard and brittle with age. **(317)**

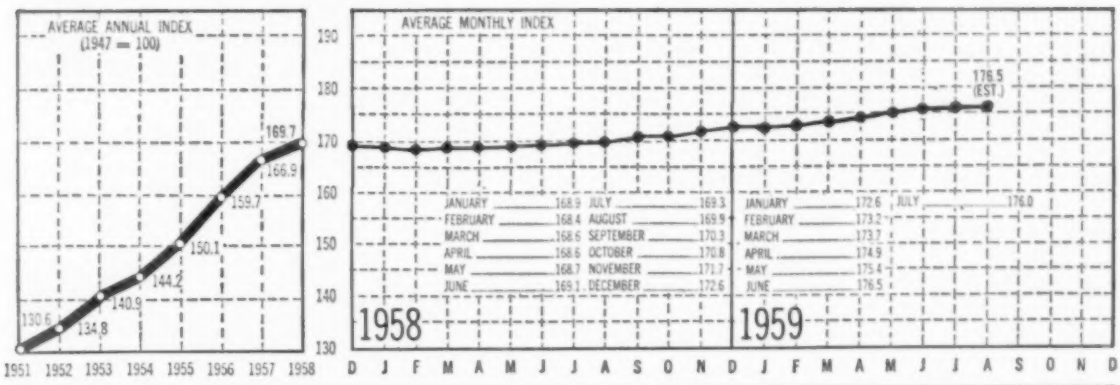
Sweat-type fittings on aluminum, brass, or copper tubing are a cinch with a new screw-type swaging tool (*Imperial Brass*). **(318)**

Belt punch and screwdriver are all you need to install low-cost cleats (*Holz*) to fabric, woven metal, or chain belting. In black or white rubber, or neoprene—in standard heights up to 4 in. Resilient construction safeguards "soft" products. Metal stiffeners for heavy-duty service. **(319)**

Portable pipe bender (*Wallace*) is neatest we've seen. Precision-built in Britain, its ram develops 8 tons of pressure through a manual hydraulic pump. Comes with 6 bending dies (½- to 2-in.), plus straightening shoe. **(320)**

(More Ideas of the Month on pages 184 and 185)

Cost Index of Plant Maintenance



First Break in '59 Costs

But costs may be expected to hit new high after steel reaches a settlement.

FACTORY'S Cost Index dipped in July for the first time this year. For five months in a row, the index of plant maintenance cost had continued its march upward from a level of 172.6 to 176.5. But July saw a drop of 0.3% to 176 even. Current costs, however, are still well above comparable figures in 1958. The July cost level was 4% higher than it was just a year ago.

The July cost decline may be somewhat seasonal. Over the 13 years for which maintenance cost data are available, costs during July declined three times. They held at the same level, or increased no more than 0.1%, during five other years. July, as a rule, appears to be a month of relatively stable costs.

August usually doesn't follow the cost-stability pattern of July. So expectations are for a cost increase in August —at least back to the June level. Maintenance costs may be expected to hit new record highs in September.

In July the costs of both labor and materials declined, with materials prices dropping quite a bit more than labor costs. Over the month, materials prices declined 0.6%, while labor costs inched down only 0.1%.

The record shows that six items on FACTORY's checklist of 39 materials cost less in July than in June. Prices of 29 items held the same. Prices of only four items were raised during the month.

The steel fact-finding report prepared by the U.S. Labor Department holds out hope that any steel wage pact will be non-inflationary.

	AVERAGE 1958	JULY (Preliminary)	JUNE (Revised)
Building and Facilities Index	**160.8**	**166.5**	**167.3**
Materials	139.2	142.0	144.5
Brick	148.8	153.2	152.7
Elec. fixtures	128.9	127.8	127.8
Elec. switches, boards, fuses	181.5	187.9	187.9
Elec. wire, copper	122.5	139.6	139.6
Glass	152.2	152.0	152.0
Gutters, spouts, ducts	172.9	177.1	177.1
Gypsum products	139.8	140.8	140.8
Heating equipment	127.4	127.7	127.7
Lumber	124.9	137.4	138.0
Millwork	146.9	157.8	157.3
Paint	130.1	130.1	130.1
Pipe, cast iron	170.4	170.4	170.4
Pipe, steel	192.0	189.9	189.9
Pipe & tubing, copper	145.7	145.4	156.9
Roofing	120.4	120.7	134.3
Sanitary fixtures	145.0	156.0	156.0
Sash, metal frame trim	146.9	141.6	141.6
Solder	117.5	124.9	126.5
Steel, structural	231.3	236.3	236.3
Tanks, steel	138.4	137.3	137.3
Valves & fittings	160.6	171.3	167.8
Wire mesh	160.8	162.9	162.9
Labor	175.2	182.9	182.5
Carpenters	160.7	170.1	171.1
Electricians	183.5	191.8	190.8
Painters	181.3	186.7	185.6
Equipment Index	**173.6**	**180.0**	**180.4**
Materials	173.5	175.9	176.3
Abrasives	160.3	161.4	161.4
Alloys, non-ferrous	117.2	123.8	126.1
Bars & plate, steel	223.5	227.2	227.2
Bearings	163.4	164.6	164.6
Belting	150.5	156.8	156.8
Bolts, nuts & screws	229.5	220.7	225.9
Chain	184.0	184.0	184.0
Controls (electric)	181.5	187.9	187.9
Gear-reduction units	181.7	181.7	181.7
Hand tools, mechanics	192.9	198.3	198.3
Lubricants	122.8	123.0	123.0
Motors	147.2	147.5	147.5
Non-ferrous metals	120.9	127.3	127.3
Precision tools	153.2	157.3	157.3
Pumps	184.8	194.8	194.8
Tools, cutting	166.3	171.2	171.2
Valves & fittings	160.6	171.3	167.8
Labor	173.7	182.8	183.2
All mfg. labor	172.2	180.3	181.1
Machine tool labor	175.2	185.3	185.3
FACTORY'S COST INDEX	**169.7**	**176.0**	**176.5**

Looking Ahead in Labor

The AFL-CIO's inter-union peace pacts are in trouble. The no-raiding agreements drawn up at the time of the AFL-CIO merger—to keep their rival unions from cutting into each other's territory—have hit a big legal snag.

Since the merger nearly four years ago, unions in the "House of Labor" have often run afoul of a basic rule. This rule says no union affiliate can seek to displace another AFL-CIO union already established in a particular industry or plant.

Up to now, at least, Federation President George Meany and his aides have prevented these disputes from getting out of hand.

•

A new decision by the National Labor Relations Board may scuttle the peace-making machinery.

Says the NLRB: A union cannot continue to represent workers at a plant where they obviously prefer another union. The no-raid pact cannot freeze the jurisdiction of a particular union.

The case went this way: The Toy Workers Union, long-established representative at Great Lakes Industries, Inc., was challenged in a representation by the Metal Polishers. The Metal Polishers won the NLRB vote, 38 to 0.

A rule by the no-raid pact arbitrator, David L. Cole, held this was an illegal raid by the Metal Polishers —and they were ordered to withdraw their petition on threat of expulsion from the AFL-CIO. The Metal Polishers complied.

But the NLRB held they could not do so on the ground that the employees obviously wanted to belong to their union. The AFL-CIO's no-raiding agreement, held the NLRB, cannot supersede its own established representation practices.

•

This ruling was a severe blow to AFL-CIO leaders. They promptly named a committee of union presidents to review the AFL-CIO machinery.

The outlook is upheaval within the Federation. Many new jurisdiction disputes are already stirring.

It costs you more to hire an older worker. This fact shows up in U.S. Labor Department figures that accompany a report to employers—asking that they hire more workers over 40.

Qualifications, experience, and productivity of the older worker are equal to those of the younger worker, the report says—and sometimes better. But the cold facts show added costs, too.

Take the steel industry's pension plans. Annual employer contribution for a worker hired at age 30 is $120 a year; at age 45, it is $214, and at age 55, it is $265.

•

These examples above were recently given to Congress by Illinois Representative Roman Pucinski. He notes higher unemployment among older workers, reluctance to hire them ahead of younger job seekers. The employer, he says, should be able to hire those over 40—and not be penalized.

Pucinski's answer: Allow the employer a tax credit for the additional costs of putting the older worker on the payroll.

•

You'll find some revealing details on all 1959 labor-management bargaining in the government's fact-finding report on the steel strike. While it contained no answers for settling the steel strike, it showed where steel stood in relation to other industries—and let the parties take it from there.

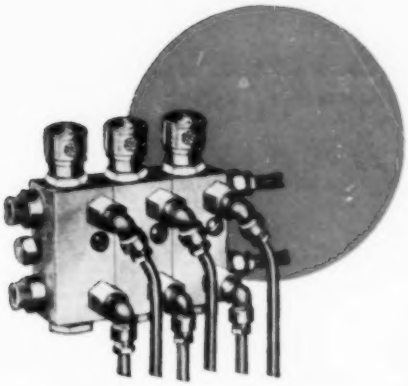
But the figures are just as helpful to other management and labor groups in rounding up the economic details for the first half of 1959. Here are some examples:

Wages—Average 8¢ to 9¢ settlements without construction, which comes out alone at 14.3¢. Negotiations with no wage increase: 4%.

Wage increases by industry—Petroleum refining, 13.5¢; pulp and paper, 7¢; gas and electric utilities, 10-13¢; cement, 10¢; chemicals, 8¢.

Automatic wage increases—2.5-million workers collecting 6¢ to 8¢ in deferred wages.

SEE LABOR RELATIONS NEWS, PAGE 212



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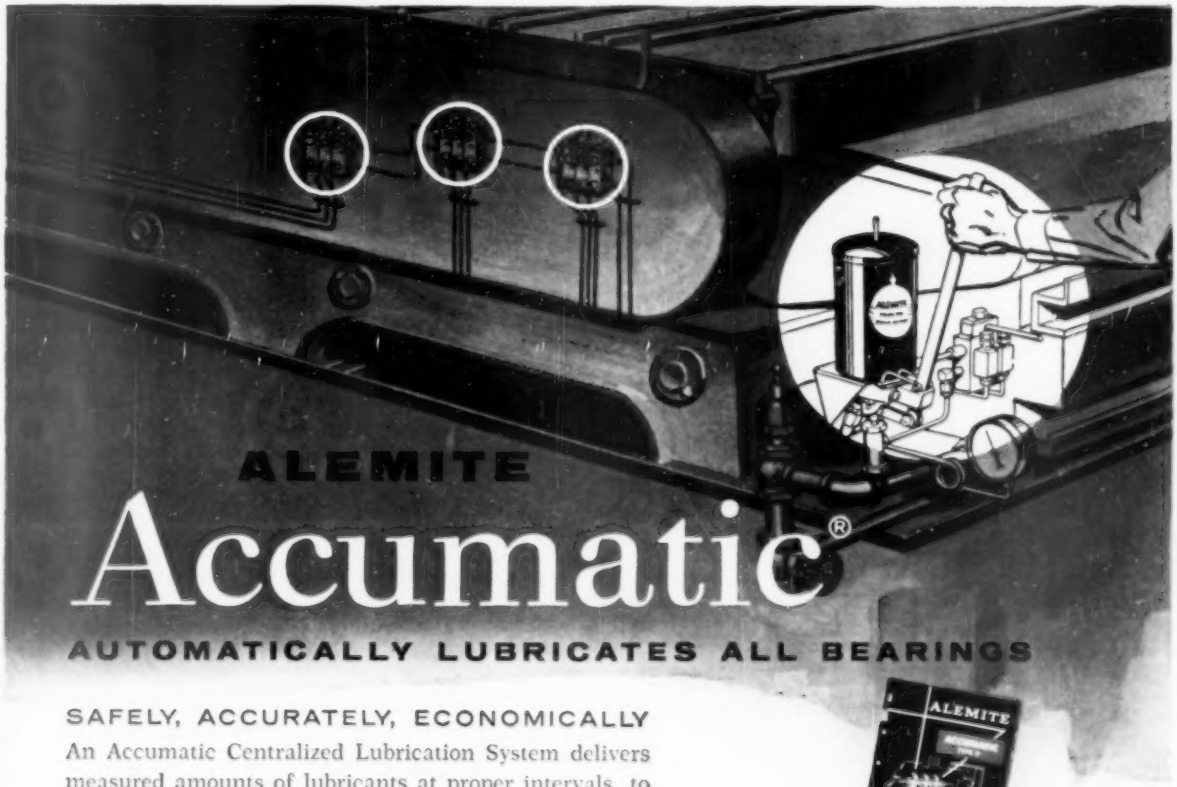

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See LOCAL SOURCES Section This Issue

Modernization's No. 1 Problem:

Modernizing Your Thinking

FOR ALMOST A YEAR, we editors have been running a "modernization campaign." We started last November with a whole issue devoted to Managed Modernization. We've continued with a series of monthly features on Managed Modernization at Work. And now we're going to have another big issue this coming November in which we report on over 500 plant-tested modernization ideas that can easily be stolen and adapted for your own plant.

All this has involved a lot of work (for example, we've been at the upcoming November job for about five months). It has led us to ask ourselves once again if all the effort is worth while—for us, and for you readers.

After some real soul-searching, we've decided the answer is yes. We see no single dramatic breakthrough that will ever solve your modernization problems. We see it, as we think you do, as a continuing job, with numberless aspects. We see it as a job that ranges from a tiny improvement in some production process to the building of a brand-new plant.

But through it all, as the headline above indicates, we see one big over-riding problem: We usually have the necessary know-how, but too often don't have the necessary attitude—the desire to improve.

A few days ago one of our editors found a good example of this in a conversation with the manager of a small plant that makes auto parts for several major producers. Some of these items must be packaged as repair parts under the customers' brand names. This is a job the company had always thought was not worth its attention and should be contracted out. Knowing this, imagine the editor's surprise when he saw a group of some 12 people off in a corner of the plant, busily making up and filling packages by hand with the help of some crude benches and fixtures. The conversation went like this:

Editor: "Whazzat? I thought you people subcontracted your packaging work."

Manager: "Well, we did for years, to a local man who used to do a good job for us. We could forget the whole thing, and the price was right. But a few weeks ago, we cut him off and decided to take the work into the shop."

Editor: "How come?"

Manager: "Very simple. This guy got fat and lazy. He kept raising his price, wouldn't cooperate, refused to modernize. We just got tired of horsing around with him. Frankly he's a damn fool. He had a good thing, and lost it because he thinks he's smarter than the rest of the world. That's his weakness. He won't learn, won't keep up."

Editor: "But why take the job into the shop? Why not find someone else outside, give it to him?"

Manager: "That's a good question. We considered that. But a funny thing happened. While we were trying to jar this guy into modernizing, we got pretty deep into this packaging business and concluded it could be made into a real profit-maker for us. So we figured we might as well keep the profit."

Editor: "Profit, out of this crude set-up?"

Manager: "Well, I'll admit this is crude, but it's only temporary. We've got an order in for equipment to do a real mechanizing job here. When we get it, we'll cut the subcontractor's price in half. But even now, the little methods improvement we've done has got it down better than 20%."

The moral of this little story isn't hard to spot. Several of our manager friend's phrases sum it up: "Fat and lazy . . . Wouldn't cooperate . . . Thinks he's smarter than the rest of the world . . . Refused to modernize . . . Won't learn, won't keep up."

All these phrases have one element in common. They indicate a way of thinking—an attitude—that somehow has gone haywire. That's why we editors are more and more convinced that before you can modernize your plant, you have to modernize your thinking.

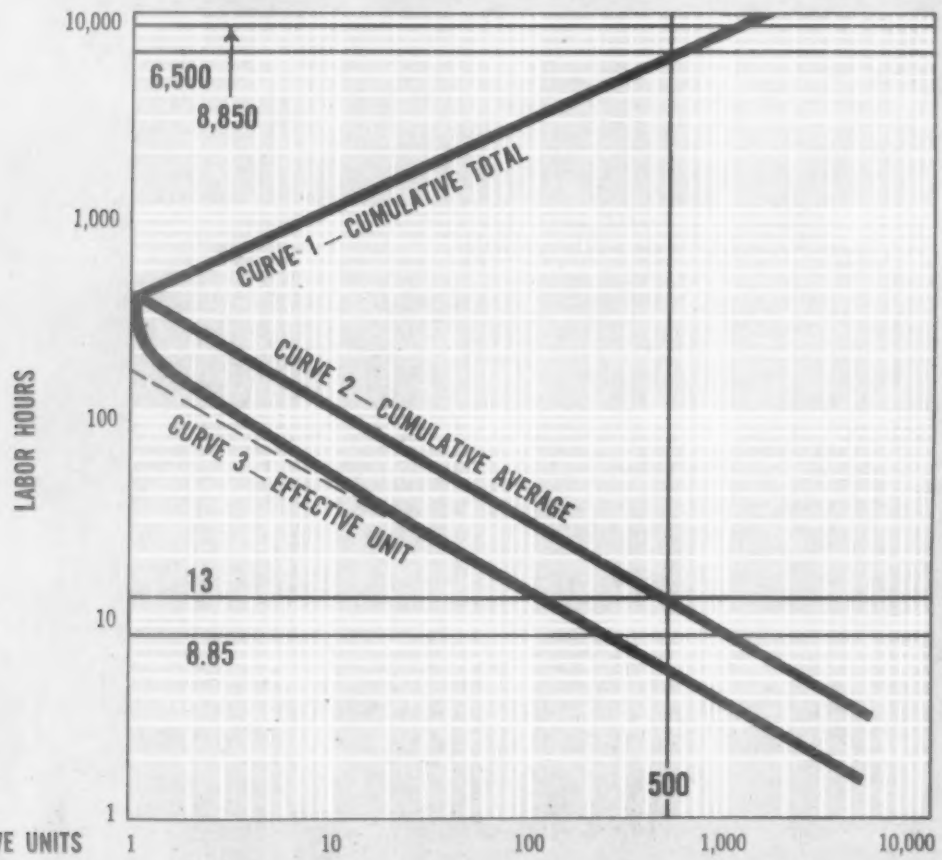
Another New Service

By the way, we hope you will be sure to turn to page 331 in this issue and take a look at "Local Sources," our newest reader service. Don White's Publisher's Letter (on the page facing "Local Sources") tells you all about it, so we won't repeat the details here. We do want to say, though, that we think Don has come up with a wonderful time-saver for busy operating men. That's because Local Sources tells you where to find the nearest distributor or representative of a good many FACTORY advertisers in each issue. It should save you the need of phoning or writing across country only to find the man you want is around the corner. Hope you like it!

THE TWO KEY ELEMENTS OF DYNAMIC EVALUATION...

COL. A	COL. B	COL. C	COL. D	COL. E	COL. F
MONTH ENDING	LABOR HOURS	CUMULATIVE LABOR HRS.	UNITS COMPLETED	CUMULATIVE UNITS	CUM. AVG. LABOR HRS. PER UNIT
Mar.-Jan.	3260.2	3260.2	START-UP PERIOD — NO FINISHED UNITS		
February	2382.5	5642.7	366	366	15.4
March	2483.9	8126.6	168	534	15.2
April	2530.7	10657.3	1392	1926	5.54
May	2717.7	13375.0	920	2846	4.70
June	2696.8	16071.8	865	3711	4.30
July	1031.8	17153.6	520	4231	4.05
August	1177.0	18330.6	625	4856	3.76
September	26.8	18357.4	246	5101	3.59

1. Production data (in columns) which you'll plot (below). The numbers alone don't tell you much. But with them you can make the performance improvement curves for Dynamic Evaluation.



2. Three performance improvement curves. Now you can spot trends in costs, cumulative totals of units and hours, average costs anywhere in the production run. Predict future costs, too.

Here's your newest problem-solving tool:

DYNAMIC EVALUATION

It's easy to use. It will take the guesswork out of many tough plant problems. And it will help you to pinpoint the spots that need attention in your operations.

DYNAMIC EVALUATION is a new way to solve plant problems. It's based on past performance. Every member of plant management can use it to predict operating results. For instance, production, cost control, purchasing, personnel, and production control can use it to:

1. Warn of production trouble.
2. Estimate costs and prices.
3. Check estimates and over-all budget performance.
4. Predict personnel needs.
5. Weigh make-or-buy decisions.
6. Determine standard cost vs. quantity values.
7. Establish budgets and "best practical" production schedules.

To see how Dynamic Evaluation (DE) solves plant problems like these, study the table and graph on the facing page—and see other solutions on the following pages.

DE is a method of studying plant operations while they are undergoing change. It evaluates the amount of change in performance, the rate of change, and the variation in rate of change. It tells where management is at any time, how it got there, and where it's headed.

You probably use something akin to DE even now. You plot production, labor hours, and various expenses, use these plots to analyze what is happening to operating results—and to predict what will happen. But such plots tell you only amount of change—not rate of change and rate of variation. You're getting "static evaluation."

DE is called "dynamic" because it shows you the changes taking place in your operation. With it, you can make your operation change in the direction you want it to change.

How DE differs—The heart of DE is the "performance improvement curve." The aircraft industry discovered and developed it in the early 1940's, called it the "learning curve." But the phrase "learning curve" is confusing and misleading because psychologists use the same phrase for something quite different.

Psychological learning curves are based on the old adage that practice makes perfect, that the more you repeat a physical or mental operation, the better you can perform it. The psychologist's curve that shows this improvement plots number of operations performed (vertical scale) against time (horizontal scale). As performance gets better day by day, the curve slopes up and to the right. But curves often reach plateaus where improvement or learning temporarily ceases.

In much the same way a production operation improves as more units are made. For instance, the unit cost of a product decreases. This characteristic of manufacturing forms the basis for mass production. But improvement is not due entirely to learning, in the psychological sense, because factors other than better labor efficiency contribute to unit cost reduction. Set-up and other fixed costs are spread over larger quantities. Better manufacturing methods boost volume and reduce cost. Quantity buying of material saves money.

The point is that over-all performance does tend to improve as production progresses. That's why the term "performance improvement curve" is more descriptive in industry than the term "learning curve."

The aircraft industry first noted the effect of performance improvement. It discovered that as output of airframes of any one type doubled in quantity, average labor cost per airframe decreased at a nearly constant percentage. If the quantity doubled (went up 100%) and the average labor cost per airframe went down 20%, this was called an 80% "learning rate" (100% − 20%). If the quantity doubled but there was no decrease in cost (no performance improvement), this would be a 100% learning rate (100% − 0%).

Instead of the term "learning rate," DE uses "improvement ability rate." Both mean the same. The latter is simply a more meaningful way of expressing potential for improvement. Theoretically, with a 20% cut in cost, there's an 80% potential for further cutting—to the point of no cost at all. But you'd reach zero only at infinity.

HOW TO USE DE

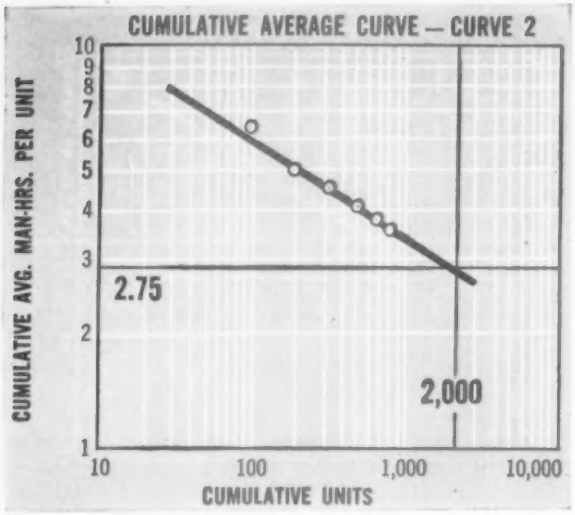
In general, you can use DE to analyze and control trends—for example, trends in labor dollars per pound, labor hours per pound, labor dollars per unit, labor hours per unit, labor hours per component, number of defects per unit. To make these and similar studies you need data over a period of time.

Once you have the data, it's easy to make a performance improvement graph like the one on the facing page. Note that it's on double logarithmic (or log-log) paper. This gives you a picture of the rate of change of your data, which is what you need to know to understand the trend of the figures and to predict what the future trend will be. If you use ordinary arithmetic graph paper, you'll see only the amount of change, not the rate. Another advantage of log-log graphs is that the trend line tends to be a straight line. Thus it's easy to extend for your forecasting.

A complete family of performance

By FRANCIS T. KOEN, Missile Systems Division, Raytheon Company
Andover, Mass.
(Dynamic Evaluation is the author's personal idea and development.)

How Dynamic Evaluation (1) predicts man-hours...



PROBLEM 1. A plant has produced 790 units. Man-hours thus far: 2765, at an average $2 per hour. Number of units manufactured each month has steadily increased. But so has number of man-hours. The plant manager wants to know if the increased man-hours will push unit labor cost higher than the $4.35 originally estimated for a run of 2000 units. Is the department performing satisfactorily? Is the increased output in line with the increased labor hours?

Month	Units per Month	Man-Hrs. per Month
1	—	258
2	92	340
3	103	373.1
4	115	402.2
5	133	407.6
6	152	450.4
7	195	533.7

Old solution—Plot production and man-hour data vs. months. Search for a consistent month-to-month trend and a correlation between the number of units produced each month and the number of man-hours expended. This method is "static evaluation." It won't give you an exact answer.

DE solution—Establish a performance improvement rate-trend. Extend the trend so you can (1) predict the over-all average labor cost for all 2000 units and (2) analyze current operations. Here are the data:

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
Month	Units per Month	Cum. Units	Man-Hrs. per Month	Cum. Man-Hrs.	Cum. Avg. Man-Hrs. per Unit
1	—	—	258	258	—
2	92	92	340	598	6.5
3	103	195	373.1	971.1	4.98
4	115	310	402.2	1373.3	4.43
5	133	443	407.6	1780.9	4.02
6	152	595	450.4	2231.3	3.75
7	195	790	533.7	2765.0	3.50

Accumulate monthly units and man-hours to fill Columns 3 and 5. Divide values in Column 5 by those in Column 3 to get Column 6 data. Plot on log-log graph paper (left) performance expense values of Column 6 vs. improvement rate factors of Column 3.

You'll get a performance improvement trend line showing a constant improvement rate (slope of line) from the 195th unit produced. Extend trend line to 2000 units. By the time the 2000th unit has been built, average labor hours per unit will have declined to 2.75. At an average labor rate of $2 per hour, average labor cost will be $5.50 each for the whole lot of 2000—$1.15 over estimated cost of $4.35.

The constant slope from the 195th unit indicates that output is in line with the number of labor hours expended at this performance improvement rate. But it's not enough to cut average cost per unit to the estimated level. The rate was satisfactory during manufacture of the first 195 units. Then a decrease in the rate of improvement occurred. Management should now review any changes made in operations during the fourth month to see what caused a decline in the performance improvement rate.

---

improvement curves consists of three inter-related curves:

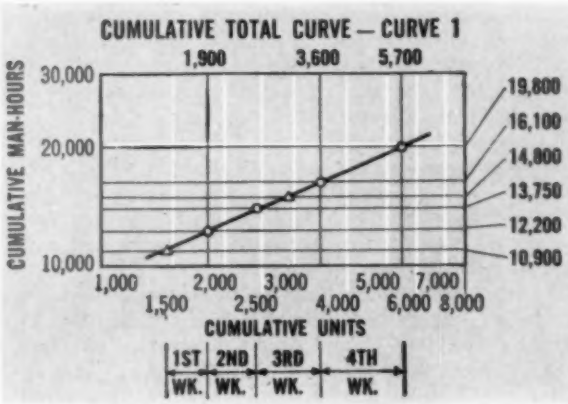
• **Curve 1**—Cumulative total curve. It's made by plotting corresponding numbers in Column C (cumulative labor hours) of the table (p. 98) and Column E (cumulative units). It shows total man-hours needed to date—and total man-hours that will be needed in the future to produce a given volume.

• **Curve 2**—Cumulative average. This one (p. 98) is made by plotting corresponding numbers in Column E (cumulative units) and Column F (cumulative average labor hours per unit). If you select a number on the horizontal scale, this curve shows average hours per unit for all units made up to the selected number.

• **Curve 3**—Effective unit. This one (p. 98) is made by plotting the quotients of numbers in Column B (labor hours) divided by corresponding numbers in Column D (units completed). This curve shows average labor hours for a small (monthly, in this case) group of units.

Now let's take a look at a concrete example of what these curves can tell us. The data plotted on page 98 are for an actual production run of 5101 electronic meters manufactured over a 9-month period, following several months of start-up time without production. The cumulative average curve (Curve 2) tells you, for example, that each unit of the first 500 units required an average of approximately 13 man-hours of labor. You spot this simply by running your eye up the 500-unit line to where it intersects Curve 2. If you go up a lot farther on this 500 line to where it intersects Curve 1, you learn that a total of 6500 man-hours was required to make the 500 units.

...and how it (2) estimates manpower needs



PROBLEM 2. A supervisor has shown a consistent 32% performance improvement rate in labor hours in his department. So far, production has been at a fairly low level—only 1500 units have been made. Average man-hours per unit is 7.3. Now he wishes to increase production over the next four weeks. He believes he can maintain the same performance improvement rate. Assuming each employee works a 40-hour week, about how many men will be required on the job each week for the following production schedule?

	Units to be produced
1st week	400
2nd week	600
3rd week	1100
4th week	2100

Old solution—Assume increased production will be turned out at a labor expenditure of 7.3 man-hours per piece. Multiply the increase in units by 7.3 hours per piece to get total additional man-hours required to do the job. Figure the number of men needed to do this on a 40-hour week. Your result won't take performance improvement into account—and so you'll hire too many extra hands for the job. That means idle time and unwanted overhead (pensions and the like).

DE solution—Establish a performance improvement curve for the first 1500 units produced. Then extend it for the new level of production, thus find the new cumulative average man-hour figures for the run—with performance improvement built in. Use these figures to find the number of men you need at each step of the build-up. Here's how you do it:

Figure total hours used in making the 1500 units: $1500 \times 7.3 = 10{,}950$ hours. The operation has a 32% performance improvement rate, or a 68% improvement ability. Cumulative average man-hours per unit for 3000 units, at a 68% rate, is 4.96 man-hours per unit ($68\% \times 7.3$). To build the 3000 units would thus take 14,880 hours (3000×4.96).

Now construct a cumulative total curve (left) by plotting 10,950 hours for 1500 units and 14,880 hours for 3000 units. To find the total man-hours to be expended from start of the program to the end of each week in the build-up period, add up the number of units that will have been built at the end of each week (Column 3) and read the total man-hour equivalent from the cumulative curve (Column 4). Successive subtractions of each week's cumulative man-hour values gives you the number of man-hours for that week (Column 5). Divide each week's man-hour expenditure by 40 (number of man-hours per person) to estimate the number of people that will be required on the job that week (Column 6).

Of course, the new personnel needed each week must be hired and trained before assignment if you expect to maintain the performance improvement rate.

Here's the table showing working data and results:

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
Weeks	Schedule (Units)	Cum. Units	Cum. Man-Hrs. (from Cum. Curve)	Man-Hrs. per Week	Approx. No. of People
To date:	—	1500	10,950	—	—
1st	400	1900	12,200	1250	31
2nd	600	2500	13,750	1550	39
3rd	1100	3600	16,100	2350	59
4th	2100	5700	19,800	3700	93

Now see what happens when twice as many units have been built (1000). The intersect at Curve 2 shows that the average man-hours per unit has decreased to 8.85. The intersect at Curve 1 shows that the total number of man-hours expended was 8850.

The performance improvement rate is 32% as you move from 500 to 1000 units. This is the per cent improvement you make in going from an average of 13 man-hours per unit to an average of 8.85 man-hours. The improvement ability rate is 68%.

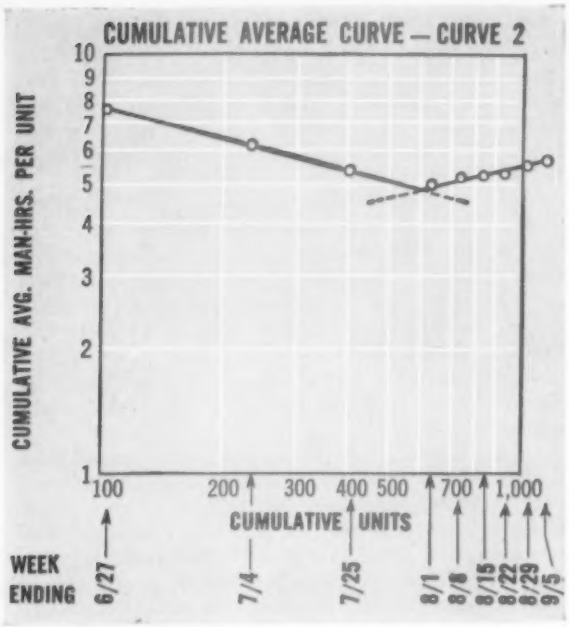
These are just a couple of examples of the kind of information you can get from such curves. You will find four more examples in considerable detail above and on the next two pages.

In making a chart you may find the points plotted will not fall in a perfectly straight line. But you can draw a single straight trend line (or series of trend lines) by visual fitting, by averaging groups of points, or by the method of least squares. (For explanation of "least squares" see any standard text on statistical methods.) As the production run continues and you gradually accumulate more data, the trend line will become more firmly established. By extending it you'll be able to predict future production results if operations continue as they have been going.

In theory, you could extend the performance improvement curve indefinitely. This is because the straight line on a log-log plot is actually a hyperbola on standard graph paper. A hyperbola gradually approaches the horizontal axis, but never really quite reaches it (except at a point in infinity).

For practical purposes the limit of

How Dynamic Evaluation (3) rates performance...



PROBLEM 3. A manager sees that one department's performance is dropping off. Granted, man-hours per unit have decreased slightly in the last week (Sept. 5) indicating some improvement (table right). But man-hours per unit for the Aug. 8-29 period have been greater than during July 4-Aug. 1. Has his department just now come out of its slump (if it has been in one)? And if there has been a slump, when did it start? The manager has the data in Columns 1 through 4.

Old solution—Plot man-hours per unit vs. weeks to see if there's a pattern to the changes. This method won't tell you much more than your hunch that something is wrong. You still don't know whether your performance rate is getting better or worse.

DE solution—Draw partial performance improvement curves for the data in the table below. You can't use the curves for forecasting because their slopes are exaggerated. But they will show changes in rates of improvement over the short run.

Compute Columns 5, 6, and 7 from table, as if the production run had just begun on June 27. (That's why this is called a "partial" curve—you're using only part of the data for the run.) Plot cumulative average man-hours per unit for the corresponding number of units produced to get the curve (left).

This curve indicates that the performance improvement rate was constant through the week ending July 25, but between July 25 and Aug. 1 it reversed direction. This new upward turn shows that performance is dropping off. The new rate has continued almost unchanged since Aug. 1. Although last week's performance (Sept. 5) shows some improvement, it isn't enough to reverse the performance downtrend. This slump may be due to a decline in worker efficiency, but it's almost impossible to tell without first making an investigation of other possible causes. For instance, some design change may have made the device more difficult to assemble. Whatever the cause, it must have occurred during or just preceding the week ending Aug. 1. The curve shows the new performance rate that resulted.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
				Partial Cumulative		
Week Ending	Units	Hours	Man-Hrs. per Unit	Hours	Units	Avg. Man-Hrs. per Unit
6/27	101	758.6	7.51	758.6	101	7.51
7/4	127	641.0	5.05	1399.6	228	6.14
7/25	168	714.2	4.25	2113.8	396	5.34
8/1	213	878.9	4.13	2992.6	609	4.91
8/8	102	603.2	5.91	3595.8	711	5.06
8/15	97	620.6	6.40	4216.4	808	5.22
8/22	110	592.3	5.38	4808.7	918	5.24
8/29	108	742.3	6.87	5551.0	1026	5.41
9/5	170	1146.6	6.74	6697.6	1196	5.60

the curve's usefulness comes long before the product is "made for nothing." The performance improvement curve indicates potential savings if the operation continues at the same rate of change. The extension of the curve does not guarantee this. You need good management and supervision to maintain performance improvement.

Seven Don'ts in Using DE

1. Don't use PI percentages to compare different plants. Performance improvement (PI) percentage has little value in comparing efficiency of different groups doing the same or similar work unless they are at about the same cumulative average curve values. For example, two plants may be making similar runs of the same product. If Plant A has never made the product before, it may be improving at a rate of 22%. If Plant B has been making the product for many years, it may be so proficient that it can realize only 7% improvement now.

But if you exercise caution, you can use improvement values to make comparisons. You can use them when the conditions or circumstances are essentially the same, as they would be if you were starting a new run of product similar to one you have previously made. Also you could establish for a plant values that are based on historical data for various products and use these values in estimating new products of similar types.

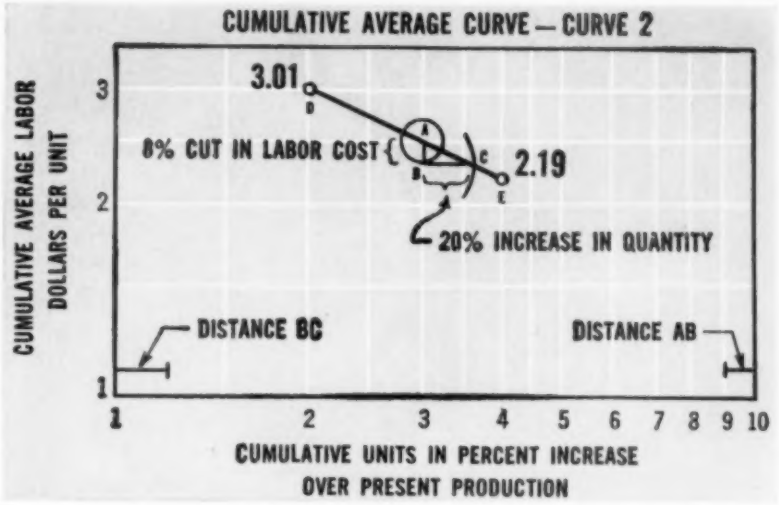
2. Don't look for the whole answer. The performance improvement rate and improvement ability rate alone do not necessarily show a company's production position. They do indicate the rate at which a company is going in the direction of improvement.

3. Don't expect a magic number. Some people are inclined to over-

...and how it (4) sets cost and price goals

PROBLEM 4. If the production manager can reduce costs on the next run of a certain product by 8%, the sales department can increase sales by 20%. Each run has always been at the same lot size, and average labor cost per unit has been steady at one value. The performance improvement rate for each run has been consistently 33%. But labor costs have been cut to the bone on runs of this length and can't be reduced further without impairing product quality.

Old solution—Try to estimate labor costs at a 20% volume increase. But that won't answer this key question: Will a production run 20% larger provide enough volume so performance improvement will reduce labor cost per unit by 8%.



DE solution—Find whether the performance improvement rate needed for the 8% labor cost reduction is within the plant's known 33% performance improvement rate.

Construct a performance improvement curve on log-log paper for the new production level. Use percentages here because no quantities are available. But remember, each full cycle on log-log paper means an increase by a factor of 10. There are no "zero" percentages. Value of the quantity doesn't make any difference either.

Choose a Point A at random for the center of a circle. Make radius of circle 8 because that's the required percentage reduction in unit labor cost. Make radius of circle equal to 8% of value of Point A on vertical scale (in this instance, 8% × 2.5 = 0.4). Alternate way to get same radius: Measure off 8% on graph scale (8% = 100% − 92%). Draw radius of circle downward from Point A thus obtaining line AB.

Now draw a horizontal tangent to the bottom of the circle. Measure distance BC by adding 20% to the value of Point B on the horizontal scale (in this instance, 20% × 3 = 0.6). Alternate way to get the same distance: Measure off 20% on graph scale (20% = 120% − 100%). Draw line BC horizontally.

Draw a line through center of circle from Points A to C. Extend line AC both ways to cover a span of doubled production (from 2 to 4 on horizontal scale). Percentage increase in cumulative labor dollars thus becomes 3.01 − 2.19 ÷ 3.01 × 10% = 27.2%.

This 27.2% performance improvement rate is for a theoretical doubled production rate. It's all that is needed to achieve the 8% labor-cost reduction for a 20% larger run.

The plant can achieve 33% performance improvement on this product, so there should be little trouble in meeting the new price goal.

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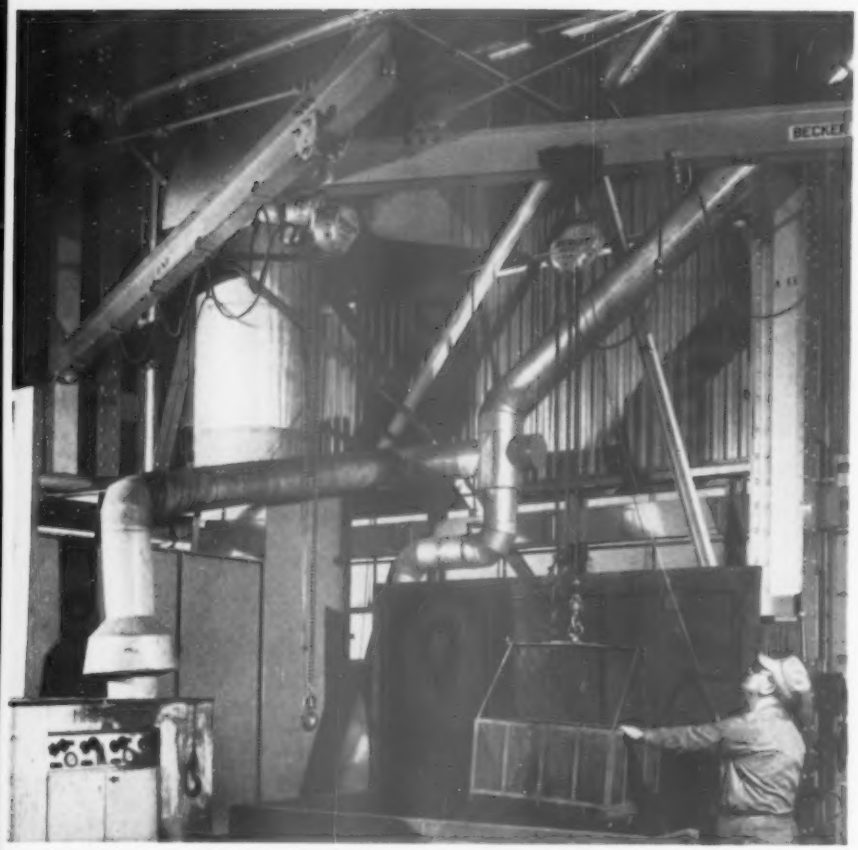
emphasize the importance of attaining a specific improvement ability value. Much of this over-emphasis is due to the fact that the aircraft industry's national improvement average during World War II was about 80%. This led many people to think that all performance improvement curves should have an 80% improvement ability value.

4. Don't look for uniform improvement. In machine operations, performance improvement is largely limited by the capability of the machines. Such restrictions do not occur in manual work, and a truer form of "learning" is shown as workers acquire manual dexterity and job familiarity. Assembly operations have a higher improvement ability than machine operations.

5. Don't put all your faith in rate of improvement. If the performance improvement rate for a product assumes a new value, analyze the cause before you conclude that improvement or deterioration of performance has occurred. For example, if a company changes to buying many items previously made in its shop, labor hours per unit of production will drop. This change in make-or-buy practice would not necessarily show up in a cumulative average product cost curve. Cost might be the same. But if the cost curve should change its slope as a result of a make-or-buy change, this would be a true indication of the wisdom of making the change.

6. Don't forecast from partial curves. Use all available data for forecasting. You may get exaggerated slopes and false indications of improvement rate from a limited portion of the data.

7. Don't forecast from charts alone. You can derive an optimum production schedule, which establishes a constant-improvement production rate, from performance improvement curves. But it may not be the best practical schedule because of limits in shop capacity. The best practical schedule is based on an improving production rate commensurate with working capacity.



For $750 per Unit, Crane Relay System

Westinghouse Electric Corporation's Manufacturing and Repair Department (Cleveland) repairs and rebuilds a variety of electric equipment. It's a job-shop operation. A handling system isn't practical. But much of the work is too heavy for manual handling.

Each major shop area has an individual jib crane. Handling service is always available—no delay. Overhead cranes are saved for longer moves. Jib cranes (Becker Crane & Conveyor Company) are 1-ton bracket-type, mounted on building columns. Each has an 18-ft. boom servicing a 180-deg. semicircle. Cranes are positioned so that the area served by each slightly overlaps the area served by adjoining units. Loads can be relayed from one work area to another.

Average cost per crane is about $750, including electric hoist.

MANAGED MODERNIZATION At Work

13 Good Ways to Spend

"TOO MUCH. We can't spend the cash."

Is that the way you feel when you learn the cost of a new handling idea? If it is, take a look at the photos and captions on these five pages. Not one of these ideas cost over $1000. Every one of them has been proved out in the plant. Every one of them means better handling—and lower costs.

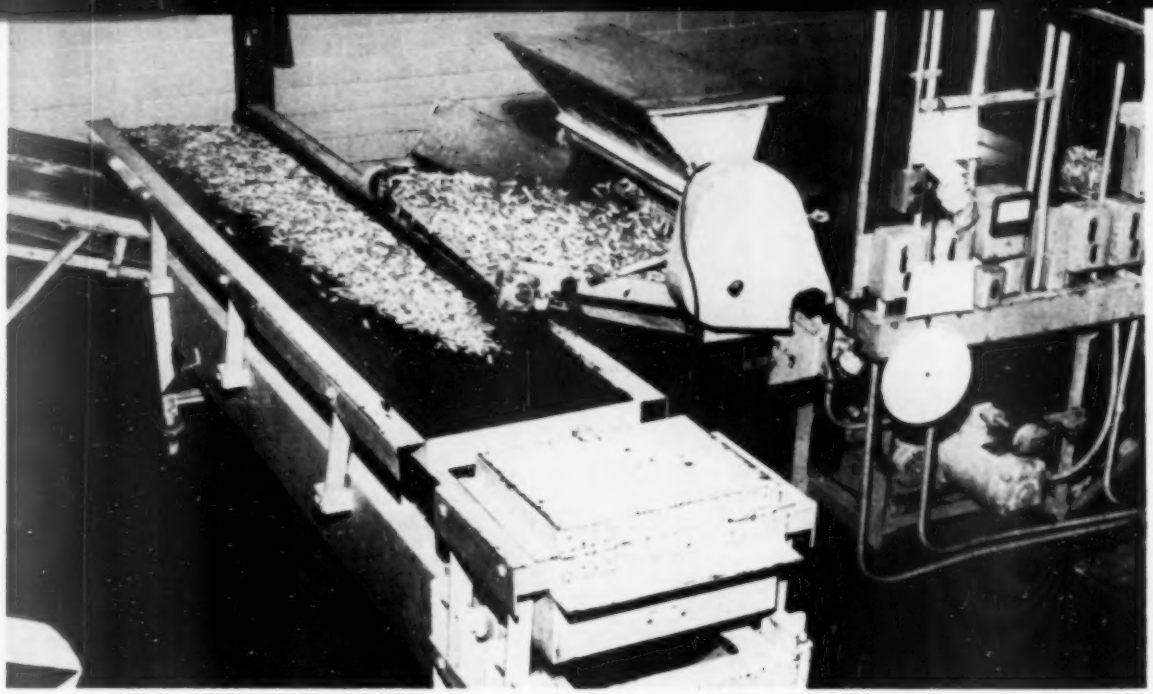
What if no one of them exactly fits your plant? Don't let that stop you. The basic idea is what counts. See if you can't adapt it to suit your plant's needs.

$680 Buys Scale Adapter

With a heavy steel plate adapter on a standard industrial scale, Rolled Steel Corporation (Skokie, Ill.) can weigh steel as long as 30 feet without damage. Scale is a 4x8-ft. pit-mounted unit. Adapter is a 6x20-ft. structural steel frame. Cost, $680. It eliminates need for blocking.

Old method of using blocking was liable to cause bending, twisting, edge or end damage. Also it was an accident hazard.

The permanent platform is no obstacle to getting accurate total weight of a number of small items.

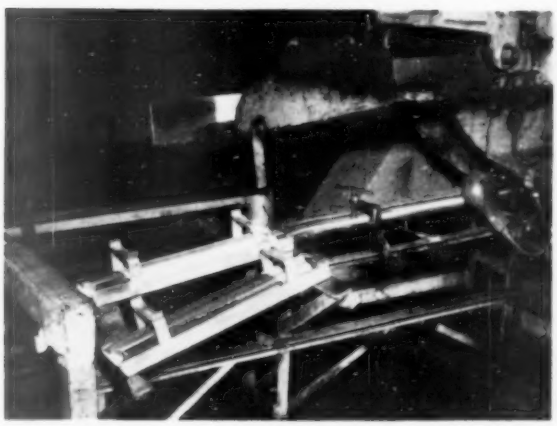


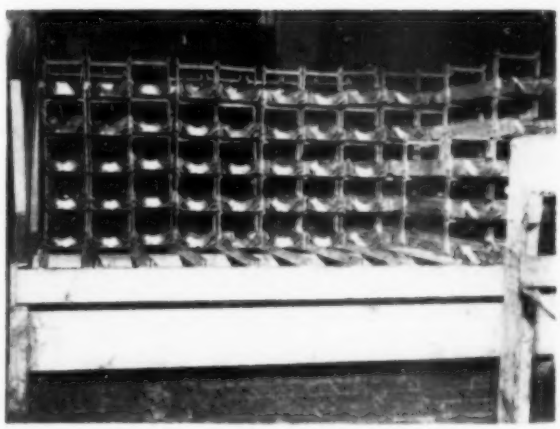
For $485, a Vibrator That Does Work of Three Belt Conveyors

This is a portable vibrating conveyor. Handles any of four products from the cooker at H. W. Lay & Company, Inc. (Atlanta). Lay built it for $485.

Products processed in the cooker might need routing over any one of three room-to-room conveyors near the cooker exit. Instead of installing three conventional stationary belt conveyors, the company built a roll-around vibrator that can feed products to the three room-to-room conveyors. The new portable conveyor operates this way: A ½-hp. motor drives a shaker unit. Shaker drives a steel support that moves parallel to floor. Leaf springs connect carrying pan to support. Pan moves up and forward at same time, vibrating product forward. Four-inch swivel-and-locking rollers provide portability. Lay says the vibrating conveyor is easier to clean than a belt conveyor.

Under $1000 for Better Handling





For $1000, Easy-Does-It Stack-and-Rack System

Ford Motor Company's Livonia (Mich.) plant cut 30% from the cost of making a small formed steel part. Key: no-hands handling, no damaged parts.

With the old method, parts dropped from dieing box into bin box, later were sorted and stacked.

For $1000 Ford added a stacking chute, made trays to hold the blades (left photo). Parts automatically slide down chute into tray. Trays are changed without stopping machine. Filled trays go into rack (right).

Turn the page

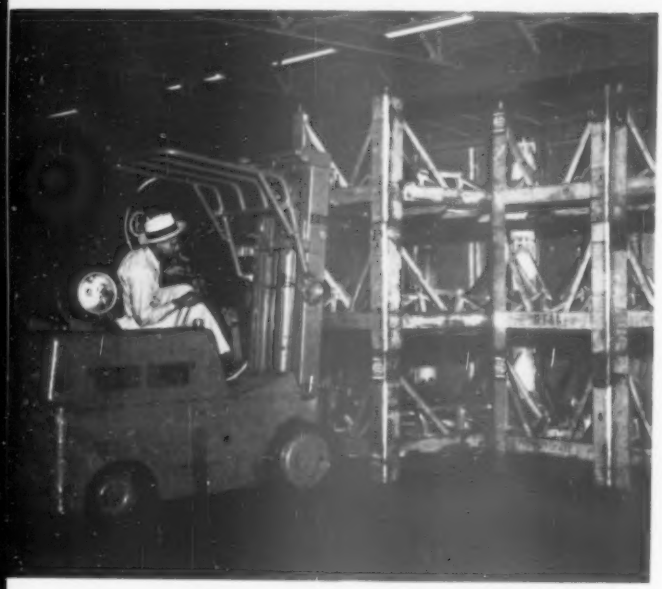
Begins on page 104

$84 Will Buy This Positioner

Packing bucks at the Owens-Illinois (Atlanta) glass container plant save workers the chore of lifting filled cartons onto a conveyor.

O-I engineers designed the positioner. A metal fabricating company makes them for all O-I plants. Unit cost is about $84.

Operator fills a carton in tilted position. When a carton is full, she swings the positioner to a horizontal position and rolls the carton onto a conveyor.



For $50. Double the Speed

Adapters on forks of trucks at Ford Motor Company's Pico Rivera (Calif.) assembly plant speed loading and unloading of engine shipping racks. The racks hold from 9 to 15 automobile engines.

Jockeying heavy, multi-tiered racks in and out of boxcars used to be slow, awkward. Fork-lift operators unloaded them by slipping a chain around the rack frame, anchoring chain to truck. Loading empty racks into boxcars was easier—chains weren't necessary. But loading required excess maneuvering.

Now a device is placed over each fork tine. A notch in the tine fits under the fork plate. A raised lip on the front end of the adapter can be used to pull the rack in maneuvering it into place.

The adapters cost about $50 per pair. Using them cuts freight-car loading and unloading time by 50%.

$700 Eases Totebox Handling

Ford Motor Company's Canton Forge Plant uses automatic crane hands to lift and move toteboxes with a traveling crane. Cost of unit: about $700.

Old method required steel ears with a hole on each totebox. Slings were placed on ears for hook pick-up, had to be rigged and removed for each move.

The new method simply involves attachment of the automatic crane hand to the crane hook. The crane moves throughout the plant, lifting and distributing toteboxes. New method saves handling time, eliminates ears (easily bent or broken) from toteboxes, improves safety, permits handling all toteboxes by crane or lift truck.

$100 Cuts Labor 33%

For under $100 H. W. Lay & Company, Inc. (Atlanta), cut manpower by one-third on single-product truck loadings. How? A hand truck.

Trucks are loaded from a roller conveyor that runs through center of warehouse, curves onto a loading ramp. OK for shipping mixed products. But large single-product shipments require single-carton handling —same as mixed shipments.

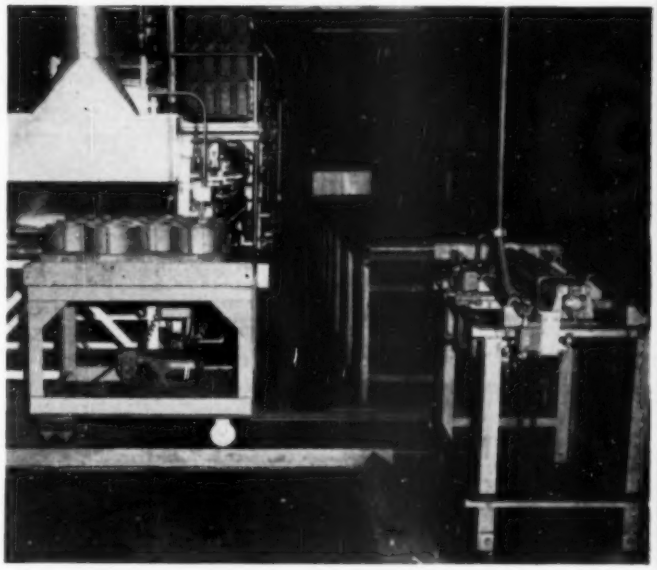
With the cart, workmen move pallet loads from storage to truck. Base for cart is a hydraulic jack lift (needed because storage racks have two heights). Two sections of 9-in.-wide roller conveyor are welded to the hand jack. Pallet is rolled off roller-racks onto cart.

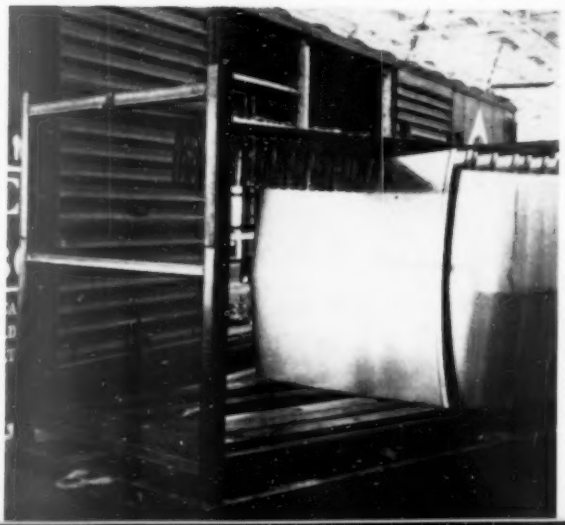
For $1000, Automatic Transfer

Reliance Electric & Engineering Company (Cleveland) installed this automatic transfer cart to connect an annealing furnace with a powered roller conveyor. It eliminates manual handling of hot trays of laminated stator cores, takes little floor space.

Pallet of cores emerges from conveyorized oven, rolls onto transfer cart, trips Limit Switch 1, thus activates cart's motor. Cart travels on track conveyor parallel to furnace. When cart is in line with conveyor, Limit Switch 2 signals push-arm to roll tray off table and onto conveyor to stock area. Push-arm withdraws, trips Limit Switch 3, thus reverses motor, returns cart to end of furnace line.

When cart is ready for next tray, Limit Switch 4 starts final section of furnace line to deliver the next pallet. Cart, track, motor drive, and controls cost less than $1000.





$75 Protects Finish on Parts

Modified truck racks cut damage to high-finish parts at Ford's Pico Rivera (Calif.) assembly plant.

Formerly racks with notched wooden center bars held partial loads in place, kept parts separated, eliminated damage. But each bar fitted only one part. When parts changed many bars had to be scrapped.

Now bolted framing channel replaces bars. Part retainers (several shapes and angles, fixed or swinging) are inserted into channel, bolted at intervals to keep parts apart. They can be covered with low-cost sheathing to protect finishes. They're bolt-anchored, can be rearranged when there's a model changeover.

Cost of channel and set of retainers starts at $75.

Begins on page 104

For $325, Easy-Move Metal Shelves

Packard-Bell's Military Electronics Division (Los Angeles) gets lots of orders for short to medium production runs. Problem: frequent moves for surplus-parts storage areas. Quickly assembled metal shelving won't do —loads are high, area must be enclosed.

Re-usable, erector-type framework solves problem. Shelving in photo, for instance, can be knocked down and relocated in six man-hours (vs. 12 man-hours for old type), costs $325 (vs. $575 for former wood and metal enclosure). Comes in variety of sizes, can be shear-cut to size, need not be bolted to floor.

For $470, Seven Money-Saving Racks

Seven truck racks like those shown in the photo returned their cost (about $470) in six month at Burroughs Corporation's Schaefer Plant at Detroit. The racks combine handling and storage operations for springs that are used in the assembly of adding and other accounting machines.

For Fast Storage, Simple Card System

Chrysler Assembly Plant (Maywood, Calif.) uses punched cards as routing slips to speed storage of six to eight carloads per day of incoming packaged freight.

Formerly, clerk removed packing slips, entered storage locations. Checker checked shipment, prepared routing slip, stapled it to incoming item.

Today, accounting gets advance delivery information, prepares IBM punched cards for routing, sends them to material department same day. Before day is done, receiving clerk enters storage location on each card. When freight arrives, checkers staple card to each package. Material goes to storage.

Gains: high-speed routing, few wrong deliveries, routing time cut three hours.

FACTORY ... SPECIAL REPORT

How to Organize for Better Maintenance

No matter how you look at it, maintenance is big business today. Manufacturing plants spend $14-billion a year on maintenance. This amounts to 4% of net sales and 5½% of cost of goods sold. And it also adds up to over two-thirds of all profits earned.

The urgent problem is how to get the best possible return for these vast sums. The solution is to start with your maintenance organization —to streamline it, bring it up to date, improve its ability to contribute to profits instead of eating them up.

In this special report, author Tom Mostyn does these things, gives you the benefit of the latest in tried-and-proved thinking and practice. He gives you the basic elements of good maintenance organization for any size of plant.

1. How to Find the Right Place and Scope for Maintenance ..... page 110

2. How to Build Productivity With a Strong Maintenance Team ..... page 114

3. How to Improve Control With Good Staff Organization ..... page 118

Turn the page

"Maintenance is more than just a service to production departments. It's a means to a profit." So says Tom Mostyn (photo) as he drives home a new concept of maintenance that's fitted to today's urgent needs—and the demands of tomorrow.

Organizing for Better Maintenance . . . *Begins on page 109*

How You Can Find the Right Place

WHAT IS the maintenance function supposed to do? What are its purposes? Its objectives?

The all-too-customary answer is: Maintain and repair plant assets. This is dead wrong. We're so used to dealing with maintenance people when machines break down that we have the idea that maintenance is just "fixing machines." Accountants often refer to maintenance costs as "burden." To them, maintenance people are non-productive second-class employees who depend on production people for existence.

If we build maintenance around such a limited concept, its organization is bound to be limited—and ineffective. We have to look to the objectives of the whole company to get a realistic objective for maintenance. If we do this, we find that maintenance has the same aims as all other functions in the business. It's an inseparable part of the over-all organization. It's dedicated to making money, making a good product, and making a good living for its members.

When we think of maintenance as a means of making a profit for the company, our concept is on a firm foundation. We then realize it's *normal* for machines to break down without proper maintenance. Maintenance therefore should be organized to cope with this normal situation, and not as a contingency needed only when everything goes wrong. Maintenance is more than just a service to production departments. *It's a means to a profit.* It's a means of keeping the plant and equipment productive and competitive.

By THOMAS A. MOSTYN, Professional Engineer and Maintenance Consultant, Port Angeles, Wash.

Without this broad concept, we can't build a maintenance organization that will promise more profitable operations through a smoother running plant. We'll make "penny-wise and pound-foolish" decisions on maintenance budgets. We'll not understand that proper investment in maintenance can change it from an expense into a profit, like any production machine. But once we in management have this concept, we're already halfway to an efficient maintenance organization.

8 Tips to Strong Maintenance

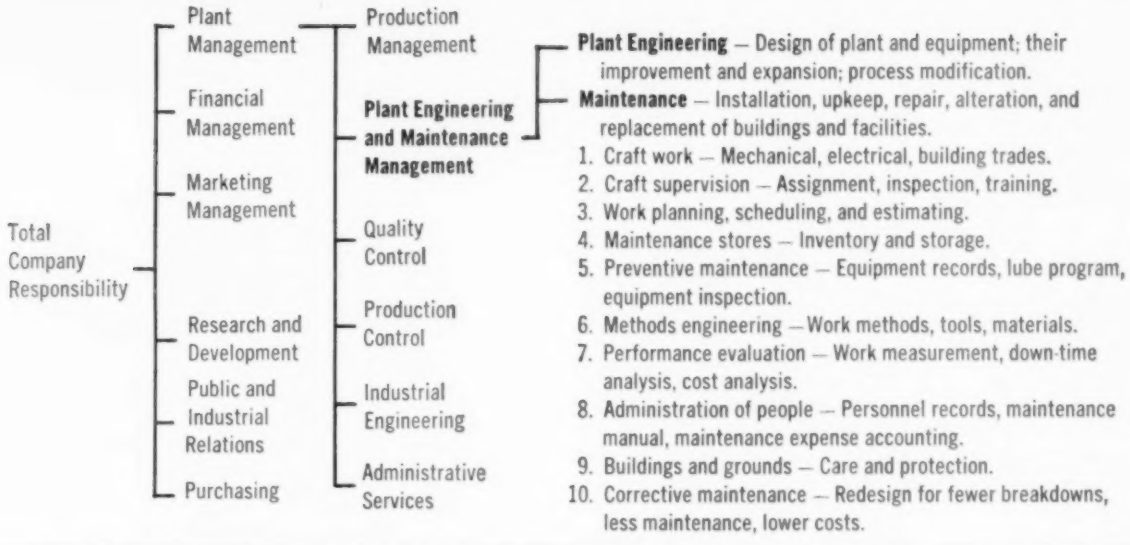
Now we're ready to apply the principles of good organization to the maintenance function. Here are eight principles to guide your decisions in charting the place and scope of maintenance in relation to all other activities in your plant.

1. DECIDE ON YOUR OBJECTIVES

They need to be spelled out to make sure your organization isn't out of round. When organized for maximum profits, maintenance must:

- Make repairs and alterations at minimum cost and maximum benefit to the company.
- Anticipate need for repairs and alterations.
- Avoid breakdowns and slowdowns of equipment.
- Train people in the skills of directing and doing the job.
- Have enough materials and supplies on hand to keep plant and equipment productive at lowest cost.

WHERE MAINTENANCE FITS IN THE COMPANY ORGANIZATION


Total Company Responsibility
Plant Management
Financial Management
Marketing Management
Research and Development
Public and Industrial Relations
Purchasing
Production Management
Plant Engineering and Maintenance Management
Quality Control
Production Control
Industrial Engineering
Administrative Services
Plant Engineering — Design of plant and equipment; their improvement and expansion; process modification.
Maintenance — Installation, upkeep, repair, alteration, and replacement of buildings and facilities.
1. Craft work — Mechanical, electrical, building trades.
2. Craft supervision — Assignment, inspection, training.
3. Work planning, scheduling, and estimating.
4. Maintenance stores — Inventory and storage.
5. Preventive maintenance — Equipment records, lube program, equipment inspection.
6. Methods engineering — Work methods, tools, materials.
7. Performance evaluation — Work measurement, down-time analysis, cost analysis.
8. Administration of people — Personnel records, maintenance manual, maintenance expense accounting.
9. Buildings and grounds — Care and protection.
10. Corrective maintenance — Redesign for fewer breakdowns, less maintenance, lower costs.

and Scope for Maintenance

2. GIVE MAINTENANCE STATURE

First question usually asked in setting up a maintenance organization is: Should maintenance report to production? I say no. Maintenance is a primary function, should be separate from production.

You may argue that its five basic duties (just spelled out) are the worries of everyone connected with production. In fact, many managements in the past have considered maintenance of operating equipment as part of production's job. Some still do.

But too many times the maintenance of such equipment suffers when it's mixed up with other responsibilities as important as production. Too often production people take the short-range view of beating daily production goals. They're unwilling to shut down periodically to maintain equipment. Thus they don't gain the long-range benefits of an accumulative high-rate production on schedule. And getting the product out consumes so much of the production supervisor's time he can't plan a good maintenance program.

That's why a good many companies have separated responsibility for the maintenance function from that of production. And doesn't this make sense? People work best when they concentrate their attention on a single, well-defined objective in an organization.

The corollary question now follows: To whom should maintenance report?

I think maintenance should be controlled by the same executive who controls production. This doesn't mean that the maintenance manager is always as important as the head of production. He may be if he has as many or more men. Chances are he doesn't. The levels in an organization chart are not sure-fire indicators of prestige. Status of rank is not the fundamental reason for placing a function high or low on an organization chart. The function belongs where it can contribute most to over-all profits.

Maintenance today has come of age. We can safely assume it will affect profits even more as automated and interdependent machines take hold. So you should organize all your plant functions with an eye to the future. If your ratio of maintenance costs to profits is on the increase, give maintenance the status it needs to be fully effective.

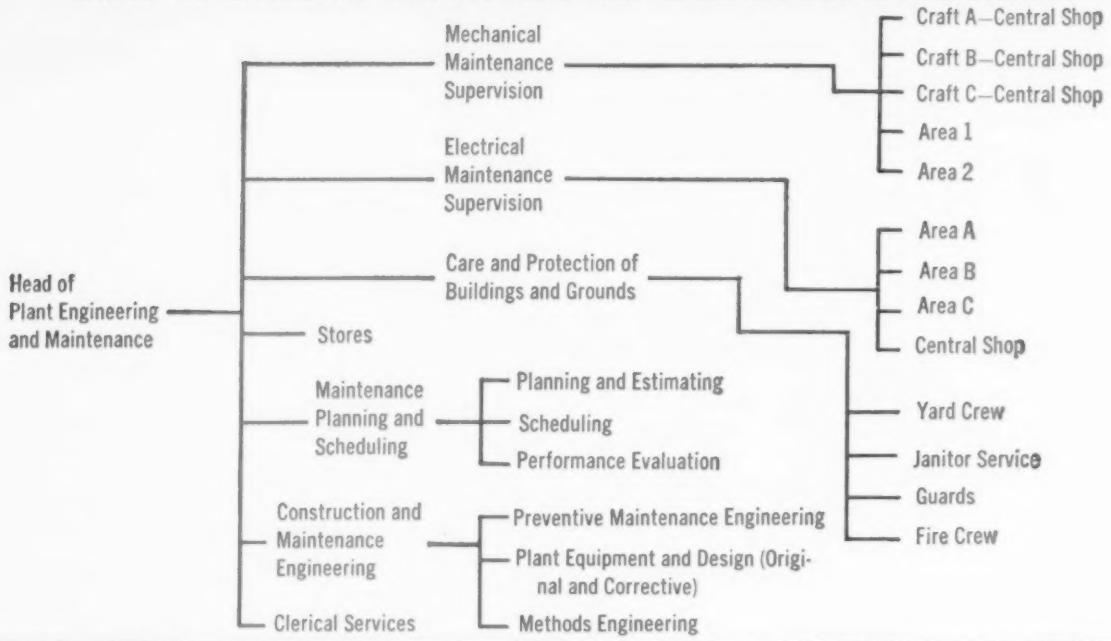
This doesn't mean that in very small companies one man must serve only one function, such as maintenance. A man can wear more than one hat. But see that at least some of the time someone close to over-all plant management is wearing the maintenance hat and looking at plant problems from a maintenance viewpoint.

3. DRAFT A COMPANY CHART

The chart above shows one way you can organize maintenance in relation to the other major functions in a manufacturing plant. Notice that we're still talking here about plant functions, not people. One man might fill more than one function, or it might take scores of men to fill one function.

This particular chart is oversimplified. It's offered more as a means of discussion than as an example of the best arrangement for every plant. In fact, there's no "best" organization that can be said to fit every

HOW A STRONG MAINTENANCE ORGANIZATION LOOKS



plant. The principles and their application are the important things to understand.

It is vital to list all the responsibilities involved, so the relationships of functions within the whole organization can be recognized in the later assignment of every responsibility.

4. MAKE A MAINTENANCE CHART

How do you translate the functional activities you need into a logical, workable organization?

Now's the time to think about types of people to carry out the functions—but still in terms of what must be done rather than specific duties and number of men. The result is shown in the chart at the top of this page. It's the framework that you later expand to a final "people" chart.

5. WATCH THE SPAN OF CONTROL

Arriving at the best organization isn't easy. Whenever you try to organize the order of responsibilities, two conflicting desires always crop up. Every man wants all functions important to his job to report to him. On the other hand, he can normally supervise only five or six people if he expects to be effective.

You can find many plants that give the plant manager a dozen or so direct subordinates. When this is true, these plants are sure to experience several of the following problems related to maintenance:

- The needs of any one subordinate will not get adequate attention if the plant manager has to split his time among too many subordinates.
- The plant manager will have to give most of his time to "putting out fires" instead of concentrating on overall direction if so many people bring so many things to his attention.
- The plant manager can't coordinate activities to the plant's best advantage if he has to attend to so many functions. Maximum productivity through preventive maintenance shutdowns may never be realized.
- The zeal of a supervisor of any function may determine the amount of attention the function receives if the plant manager is so over-busy. Over-aggressiveness of the maintenance manager may yield a higher quality of maintenance than is justified.

Every executive wants to be close to the important problems within his responsibility. Yet he doesn't want to be buried. He wants the number of executive and supervisory levels to be few so that he won't be isolated from the work taking place. Yet he wants to delegate routines and have only exceptions to routines come to his attention.

Any organization must be a compromise between these conflicting desires. So don't expect any organizational scheme to answer all your needs exactly. It won't. But it should provide the plant manager with six or fewer function managers, one of whom will be the maintenance manager.

6. GET A MAINTENANCE MANAGER

What kind of person is best suited to managing the maintenance function? What training, knowledge, and abilities are most important? Effective maintenance programs include redesign and improvement of equipment. This means engineering—and calls for supervision by an engineer.

But the manager of maintenance should be more than just a capable engineer. He must be a manager. He should be able to work with "people" ideas as well as "technical" ideas. He should understand the use of money, methods, and men as well as materials and machinery. He should be able to organize his thinking into a long-range program of improving maintenance performance. He should be proficient in developing administrative procedures and ways of coordinating people.

What specific title to give such a man? For the type of organization shown in the charts, I prefer "Plant Engineer." In these charts he's responsible for plant engineering (design of plant and facilities) and plant maintenance (upkeep of buildings, facilities, and equipment). This represents the set-up in 46% of 359 plants in a recent survey on "Maintenance Management Practices Today" (FACTORY, September 1958). Three other groups (total 54%) show wide variations in which a segment of 24% shows no direct supervisory connection between the two functions. Therefore we can't dogmatically assert that the first-mentioned set-up is best for all plants. It's the most popular, and hence suggests second thought before you depart from it.

As for titles, the same survey indicates "Plant Engineer" as the most frequent title of men in charge of plant design, and "Maintenance Superintendent" (followed closely by "Plant Engineer") as the most frequent title of men in charge of plant upkeep. I shall therefore use the terms of plant engineer and maintenance superintendent from here on to indicate the heads of the main functions of design and maintenance respectively. Either way, the generic term of maintenance *manager* can apply to both.

7. WEIGH OTHER SERVICES

Should other functions be combined with maintenance in your organization? There are advantages. For example, take new construction. It's often teamed with maintenance under a plant engineer. Both activities require the same knowledge and skills to manage. You can often even out the normal peaks and valleys in construction workload by supplementing construction with maintenance work. But where construction is a fairly continuous workload or where reliable construction labor is available locally, a separate construction crew has advantages such as these:

- Work can be planned in detail and closely controlled. Costs also can be reduced and better controlled.
- Craftsmen specializing in construction become more proficient in this type of work.
- Completion time can be predicted more accurately when a steady crew is assigned to planned work.
- Quality of construction can be improved when one man and a crew are responsible for total work.
- Construction problems don't interfere with maintenance duties.

Even where there are separate construction crews or work is contracted out, it's usually managed by the plant engineer. Good construction is the first step (after good design) in good preventive maintenance. The two activities are so closely related that they should be made the plant engineer's responsibility.

Other responsibilities are often placed under the plant engineer's control, such as power-plant operation, salvage, janitorial services, sanitation, and transportation. If such additions become too numerous for the plant engineer to control directly, you may have to add an intermediate level. Often where the janitorial or sanitation requirements (say, in food plants) involve much manpower, the heads of these functions report directly to production or plant management.

In many a large organization you may have to interpose a maintenance superintendent in direct charge of mechanical, electrical, and building-grounds maintenance. If you do, you may wonder whether to disturb the other functional relationships (stores, work planning and scheduling, and so on).

What you do will depend on the division of the administrative load between plant engineer and maintenance superintendent—and on their capacities and abilities. The load seems more equalized when the maintenance superintendent is responsible for line functions only. But if he has time and capability, there's no reason he can't take over planning and scheduling or any other maintenance staff functions. The important thing is that every function get adequate attention and supervision.

8. WEIGH PRODUCTION FORCES

Where men in production are not fully occupied with production routines—and where union agreements allow it—production workers can help in maintenance work. But don't weaken your organization by allowing production to take over any of the basic responsibilities of your maintenance function.

For instance, the maintenance manager can lay out lubrication schedules—lubricant and frequency. Or he can prescribe simple preventive maintenance duties that are easily and competently handled by operating forces. If production supervisors agree to follow these schedules, they can be responsible for supervision of the work. Control reports, such as completed lubrication checklists, can be set up and reviewed by maintenance management for controlling the work done by production people. Maintenance can further follow up by periodically spot-checking the work as it's done. But maintenance retains over-all responsibility.

The point is, don't let your original concepts become diluted by expedients. It's one thing to draw an organization chart, and another thing to stick to it day by day. For example, often a plant places full responsibility for maintenance on the maintenance manager. But then because a couple of man-hours are available in some production department it turns over a piece of that responsibility to someone in production who has little time or interest in maintenance.

Lubrication is a common case in point because it is the most frequent gray area in an otherwise black-and-white definition of responsibilities. The chart may pin the responsibilities of preventive maintenance onto the maintenance manager, yet countenance an unwritten policy that permits production foremen to lubricate their own machinery. This lack of consistency between general policy and actual practice can only result in lack of control and in an aftermath of inadequate maintenance performance.

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"Good job descriptions (facing page) determine whether you want a 'straw boss' or a real foreman." That's one point Tom Mostyn makes as he answers five key questions on maintenance organization.

How to Build Productivity With

WE DEVELOPED the framework of the maintenance team in the chart on page 112. But it contains a mistake. It shows line functions in a separate level from staff functions. We did this so you could see which is which in our line-staff nomenclature.

In the team concept we should think of all these functions in one unbroken bracket under the maintenance manager. Much of the trouble in getting top management to allow enough staff develops because we're prone to set staff apart in our thinking and apply terms such as "unproductive" or "indirect" labor.

Each function, whether line or staff, must have a purpose in making a profit. Otherwise it shouldn't be in the organization. The only real difference is that the staff functions must produce their part of the profit by making the line more effective, whereas the line produces profit directly.

It's time we all thought of functions as essential or non-essential, and stopped putting one function above or below or on a par with others. Once we grasp this concept, we won't foolishly chop off the staff functions when the going gets rough. And neither line nor staff men will get the idea they are more important.

Above all things we need to drive home these truths —especially to top management. To cast out any remaining doubts as to their impact, take a look at the typical way a major maintenance job is processed:

- Production people conceive the need for a repair, including a modification to equipment.
- Engineering (staff) designs the change.
- Maintenance planning (staff) plans the work sequence, orders materials, arranges for equipment downtime, collects all information the crafts need to do the work, sets time standards on the job.
- Foremen (line) assign work to specific craftsmen (line), instruct them in the plans supplied.
- Craftsmen (line) do the work.
- Engineers (staff) check the work against design.
- Production starts up equipment, with engineers (staff) and foremen (line) present to spot design bugs.

Now where would *you* draw the line in the concept that staff only advises, and that line issues orders and does the job? Each of these steps is integral to the job. Each function contributes the part it's best fitted for. If any step is slighted, the job doesn't get done properly. All the functions are productive and all are members of one team.

5 Key Questions on Organization

We can now safely discuss the line and staff segments separately. While their objectives are one, their organizational problems are different.

Let's start with the line—the workforce and its direct supervision. We'll concentrate on the big problems, those that come up time after time at maintenance conferences and management seminars.

SUPERVISOR'S JOB DESCRIPTION

Position: Millwright foreman.

Department: Maintenance.

Supervisor: Maintenance supervisor.

Primary function: Supervise crew in inspection and repair.

Duties and responsibilities:

1. Assign work according to priority and capabilities.
2. Arrange "Next Job" section of shop Taylorboards according to work planned for each man.
3. Assist men in planning work and understanding instructions.
4. Authorize withdrawal of materials from stores by men.
5. Inspect progress of work.
6. Inspect work completed.
7. Signify satisfactory completion by initialing work orders, returning them to maintenance clerk.
8. Help maintenance planners find best method of doing work.
9. Estimate man-hours and materials to complete foreman's portion of work orders.
10. Train men (on-the-job) in craft skills, equipment knowledge.
11. Supervise recording and distribution of men's time.
12. Assign overtime equitably.
13. Set up an equitable vacation schedule. Approve leaves of absence.
14. Submit reports on:
    a) Daily labor.
    b) Overtime and call-time.
    c) Breakdown and emergency repair.
    d) Disciplinary action.
    e) Commendation.
15. Counsel men; interpret policies, practices, procedures.
16. Recommend promotions, demotions, hirings, firings, transfers, and disciplinary action.
17. Receive, process grievances.
18. Coordinate work of men with men of other crafts.
19. Maintain shop area and shop tools in efficient manner.
20. Advise storekeeper of materials and parts needed for operation.
21. Help production foremen detect faulty operation of equipment.
22. Recommend tools and equipment to be used by crew.
23. Recommend to maintenance supervisor repairs, alterations, or replacement of equipment.
24. Supervise operation of PM; assign and review checklists, supervise inspections.
25. Arrange safe working conditions for crew. Advise maintenance supervisor of unsafe machinery and practices.
26. Arrange for proper disposal of scrap generated by crew.

a Strong Maintenance Team

1. HOW MANY MEN FOR A CREW?

How many men should report to one foreman? The answer depends on how much supervision each man requires to be most effective. That, in turn, depends on these four factors:

- **Nature of the work.** If the crew does the same work over and over, a foreman can supervise more men than he can in non-repetitive work. Painters need less supervision than electricians.
- **Skills of men.** Highly trained, long-service men need less supervision than newer men who are just learning. High turnover in the workforce calls for fewer men per foreman.
- **Support from staff organization.** Well-defined and thoroughly planned work needs less supervision than work that has not been carefully prepared before being assigned.
- **Need for proficiency in maintenance.** Will more supervision justify its cost? This depends on how much maintenance affects your profits.

It's common practice to have one foreman over anywhere from 10 to 50 workers. Obviously, with such a wide spread we aren't talking about the same level of maintenance proficiency.

The thing that management fears most—over-supervision, that is—is not the most serious problem you face. The real problem is getting your money's worth from the supervision you do apply.

You won't get your money's worth if you don't understand how a supervisor can be most effective, and therefore don't train him to this end. The optimum ratio of workers per supervisor depends greatly on the kind and amount of training you give to your supervisors. It depends also on the quality of the direction they get on the job concerning what's expected of them.

The concept of what a supervisor should be runs all the way from "manager of men" to "straw boss." We've all seen too many straw bosses on a job. You can't improve management of a poorly supervised group of men just by adding more poor supervisors. That's going at it the wrong way.

I submit that the big confusion about the ideal worker-foreman ratio is caused by the wide difference in opinion about what the supervisor is supposed to do. Companies that support a low worker-foreman ratio have faced up to the multitude of problems that can and should be handled at the foreman's level. So the decision as to the best ratio really depends on top policy. If you think the best way to supervise maintenance men is to turn them loose on the job and let them figure it out for themselves, you can get away with little supervision. Adding more supervisors just because it's par for the course won't improve your maintenance performance.

To sum up, I have never seen a plant where the workforce had too many *good* supervisors.

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"...can't improve by adding more poor supervisors"

2. WHAT MAKES A GOOD FOREMAN?

"Foreman" means different things to different people. We're using it here as the first line of supervision. Whatever the definition, we must be just as specific in defining his duties as we have been in analyzing each facet of the maintenance function to insure a smooth-working and effective over-all organization. This you can do by building a fence around your concept of the foreman's duties and responsibilities in the form of a job description (page 115). The size of your fenced-in area determines whether you want to have a "straw boss" or a real foreman.

All maintenance people should be covered by job descriptions. Supervisory people should be assigned to jobs described for each individual. Hourly wage people can have their jobs described as a group activity. There's no sense, for example, in duplicating descriptions for each millwright.

Each job description should tie in with the functional organization chart and the "people" chart. It cements and holds the two together. Organization charts are only a graphic picture of relationships. Job descriptions give them meaning by putting flesh on the skeleton and injecting life-blood and coordination among all the uniquely skilled members.

Earlier we mentioned the transition from a "function" chart to a "people" chart. The middle step is the determination of duties and responsibilities for each function. You do this with job descriptions. Next, you apply appropriate titles (which can be meaningless without a job description) to each function. For example, you might list "Master Mechanic" in the spot of "Mechanical Maintenance Supervision."

Now you're ready to develop the "people" chart, by choosing personnel who best fit the job descriptions. You may have to go back and revise the apportionment of duties in some job descriptions and transfer them to other jobs, because some individuals can't handle them. But at least you never drop any duties out.

3. CENTRAL CRAFT OR AREA PLAN?

Merits of decentralization—Some companies claim these advantages when the maintenance department is split up into areas of the plant:

- Craftsmen become more familiar with the equipment they work on. Less planning time on repairs is required. Workmanship is more likely to fit the specific needs of each job.
- Craftsmen feel more responsible for productivity of equipment when they are identified with a particular department of the plant. Preventive maintenance is likely to be more effective.
- Maintenance work is more easily coordinated with production when craftsmen constantly work with the same people in production.
- Travel time and other delays to work are reduced when the craftsman is located right in the department he services.

Merits of central shops—Yet not everything is rosy with decentralization. Centralized craft shops claim advantages, too, as follows:

- Craftsmen in a centralized shop servicing all departments gain a wider work experience. On-the-job training includes a broader variety of work.
- Craftsmen can be reassigned to any part of the plant as needed. Use of the workforce is flexible.
- Craftsmen can be controlled. They identify themselves more closely with maintenance goals than with individuals in the production departments.
- Craftsmen have traditionally accepted craft divisions in a central shop. When assigned to an area, they are likely to feel they have lost their association with others of their kind.
- Replacement of a craft foreman is much easier when the selection can be made from a large group of diversely trained men.

Getting just what you need—Many companies have changed from central to area set-up not because they've weighed advantages against disadvantages, but because the area concept fits a popular cliché. For example, "You get more effectiveness when everybody is his own boss." Thinking this way, they break up their organizations into smaller and smaller units. They have no conception of how to control such an organization because they never had a sound idea of why the organization should have been split up in the first place.

The motivation of decentralization is idealistic. It can be effective where appropriately applied. But it's no cure-all. It's no substitute for good direction or coordinated control. It can create a spirit of separateness instead of cohesive unity of purpose. If you fail to tie it together with appropriate controls you end up with a number of little kingdoms, each of which goes its own sweet way.

But you can overcome these disadvantages if you know what they are. By planning and scheduling the area maintenance work from a central office you can assure attention to the most important jobs. A centralized preventive maintenance program will prevent the spotty results of poorer equipment condition and higher costs that area programs allow. Centralized methods study can bring the best methods to all areas instead of waiting for each area to develop its own. In other words, once you study the good and bad about an area set-up, you can design practices and procedures to meet the need.

Sometimes a maintenance organization can be split to advantage into a central group and one or more area groups. Much will depend on plant size and type of work to be done. Building a brick wall in one part of the plant may not differ much from building a brick wall in any other part. Similarly, the skills and knowledge required to maintain pumps in your different departments may not vary. In this kind of work, men may work best when assigned to a central-shop group.

On the other hand, troubleshooting a special complex machine may require intimate knowledge of that machine and that part of the plant. You may well decide,

therefore, that the same man should work on that machine whenever it needs maintenance attention. This may lead you to assign him other work in the area so that he may be specially trained in the maintenance needs of that area. If a good deal of maintenance work occurs in this particular plant area, other mechanics may be similarly assigned. This way, you'll find yourself justifiedly committed to "area maintenance" for this special problem.

The concept of decentralized maintenance comes to full bloom when supervisors are also assigned on an area basis. This occurs mostly in large maintenance departments. But watch out for misleading interpretation of different people's experience with area maintenance. Often large maintenance organizations have experienced the best results from decentralizing. Each of their area groups may be larger than the whole of your maintenance organization. In smaller plants, craftsmen may specialize in servicing one section of the mill and still be assigned from a central shop. Get all the facts before you decide what to be.

4. USE MULTICRAFT FOREMEN?

Traditionally, maintenance men have been grouped and supervised according to crafts. But more and more companies are finding that coordination of crafts is a bigger problem than supervision within a craft. So they have moved in the direction of assigning foremen to crews consisting of many crafts.

The size and make-up of the crew depend upon the work assigned to the foreman to supervise. Foremen with a multicraft team may be assigned to a particular project, or to an area in the mill. Either way, the reason for crossing craft lines in assigning a common foreman is to pinpoint responsibility.

Craftsmen may be assigned to a multicraft foreman on a permanent basis for a series of jobs in an area. Or they may be assigned to one or another foreman on the basis of skills needed for one or more jobs currently assigned to him. Either of these moves presupposes a high degree of job planning. Unless he knows what crafts and how many men are needed at what times, the multicraft foreman may be faced with a situation that will waste more man-hours than if the work had been assigned to several single-craft foremen in a centralized organization.

You can expect craftsmen to resist any shift from single- to multicraft supervision. They'll say it can't be done—"What does a piping foreman know about electrical work?" They may feel insecure—afraid of how this change will affect them personally.

Let's admit this is a radical change for both foreman and workers. But the facts are that foremen usually can pick up know-how in the various craft skills faster than the craftsmen's pride will allow them to believe. And you need to lay bare your program, get workers to understand and accept the goals as worthwhile. If necessary, let the die-hards know you won't allow sabotage designed to prove the concept is no good. Take it from me, success doesn't come overnight. But persistence, patience, and time can win out.

The "leading craft" idea—This has some of the advantages of the multicraft set-up. And even with a centralized craft organization you can assign any particular job as one foreman's responsibility. If you do this, the "leading craft foreman" will usually be the foreman whose craft has to perform most of the work. He coordinates the work of all crafts on the job. He answers to management for results. But he has to work through other craft foremen in matters of workmanship, work methods, and discipline.

True, the lack of direct authority over all men on the job dilutes his effectivenes. But this concept is often a good compromise. It preserves the craft organization accepted by labor. It enables a craft foreman to continue craft training of men under his supervision. Assignment of work under accepted lines of craft jurisdiction is easy to supervise.

5. USE MULTICRAFT MECHANICS?

Study of the way craftsmen use their time in maintenance departments has led many companies to develop the "generalist" mechanic, a man who is trained in skills common to all crafts. Where three to five different crafts may be needed to complete a simple maintenance job, some companies are applying a multicraft mechanic who can complete the job himself. Application of such a jack-of-all-trades eliminates the problem of one craft having to wait for help from another, simplifies coordination of craftsmen by supervisors, and can result in lower-cost maintenance.

Single-craft mechanic—Much can be said for him:

- Training is simplified, job knowledge is confined to areas within the grasp of most men.
- Job competence is easy to define and obtain.
- Skill in the use of tools required to complete jobs is more easily attained and is usually developed to a higher degree.
- Recognized craft unions accept the traditional division of crafts. They will permit invasion of craft boundaries only at a price. The question of which type of men will produce the lowest total maintenance and operating cost in any particular case depends upon the kind of work done and how intricate and complicated maintenance may be. You just won't find an expert in all phases of instruments, electronics, hydraulics, mechanics, welding, etc. He'd have to know too much about each separate specialty. But specialists in single crafts can do much of the work in all crafts. That is, in most of the work done in industry, multicraft men can be trained to do satisfactory work.

In any one plant it's a matter of analyzing maintenance jobs for work content to determine the extent to which you can use multicraft men. In most factories today, analysis would show that specialists are still needed in maintenance—highly skilled craft mechanics for the difficult jobs requiring special knowledge and skills. Also, there's room for highly skilled men who know the fundamentals of all crafts.

In some cases craftsmen must specialize to the point of knowing little except the repair of a single machine. Just what the optimum degree of specialization should be depends upon the work content of the normal maintenance job. Specialists and generalists might even be useful on a single job: namely, a troubleshooter to locate and define the need for maintenance work, and a generalist to make the repair.

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Organizing for Better Maintenance

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"Good organization doesn't work by itself. A perfect cutting tool still needs a skilled craftsman to guide it." This is Tom Mostyn's parting shot as he talks about staff organization in maintenance.

How to Improve Maintenance Control With...

Better Organization for Your Staff

THE WORD "STAFF" usually implies an advisory capacity. But it should equally imply controls.

I'm always amazed at how many sound-thinking men consider controls of all sorts as a sneaky way of giving a man hell. Supervisors often see control as a limit on their prerogatives or their freedom in making decisions. Foremen and craftsmen often take it to mean, "They don't trust us any more."

Some of this attitude is certainly due to management's failure to make clear the meaning and purposes of control. It needs full understanding if you're trying to build control with staff responsibilities in your organization.

Control means to plan and follow up closely rather than let happen by chance. Planning is a means to control. But supervisors and foremen should be free to change the planning as long as they can improve it—and get agreement from the planning staff or maintenance manager that the change is an improvement. Viewed this way, planning as a control is an opportunity to do a better job rather than a straitjacket for maintenance supervisors. It's their opportunity to improve the thinking of others or to learn themselves.

In either case, the combined ability of planning staff and maintenance supervision can improve the work situation and the ability of the maintenance organization to produce better company profits and products.

Control can be extended to report techniques, such as comparing the estimated time and the actual time required for maintenance jobs. Control in this sense should mean a joint effort to improve by evaluating performance. It is not a means of making someone the whipping boy. Of course, if a foreman is deficient, good controls will show where he is lacking. On the other hand, good controls will show up superior performance by a foreman, too. No one should seriously object to having his abilities made known. Usually people object only to unfair measurement of their abilities or constant criticism of falling short of perfection.

MAINTENANCE PLANNING

Every maintenance job has to be planned. The big question is who should do it.

If a job is given to a craftsman unplanned, he'll have to plan it. He'll have to figure out what's needed, how it should be done, when, where, what materials, who should help, and so on.

Compare this with the steps in a typical staff organization. The staff planner receives maintenance requests. He lists the steps required to complete a job, the crafts involved, special materials, and other information. With the help of craft foremen the job-time is estimated and material requisitions are prepared. Meanwhile, the maintenance head assigns priority. A maintenance clerk handles all the routine filing, scheduling, and dispatching of work orders to foremen, also equipment records. The maintenance head always knows how his crafts are loaded. Thus he can predict work progress and revise schedules, if necessary, ahead of time. In larger organizations a work planner even arranges to deliver tools and materials to the job site.

Just how refined staff planning should be depends on the size of the organization and the gains made thereby. But such refinements come later. The big issue is whether or not you will organize for staff planning.

High-cost planning—Here are the penalties in time, cost, and worker performance that you incur when you

allow maintenance jobs to be planned at the craftsman's or the leadman's level:

- Because the craftsman is not given details of the work to be done, he (and often his helper) spends time looking for information. This often happens when the information is hardest to get—when the requester of the work is busy with other matters, in a meeting, or even on vacation.
- Because the craftsman isn't directly responsible for another craft's work, he usually doesn't plan the other craft's work when it's most convenient for that craft. Result: delays to the work, waiting for services of supporting crafts, peaks in supporting craft workloads, wasted man-hours, poor performance.
- Because foremen don't get details of job requirements they are likely to assign too many or not enough men to the job (usually too many, just to be safe).
- Because need of materials is not planned ahead of the assignment, jobs are often interrupted, makeshift repairs are made, or jobs are reworked.
- Because craftsmen set the method of doing the job, engineers get little opportunity to establish the best system. Improvements in job methods crop up only after the job is finished. Methods control thus becomes an expensive after-the-money-is-spent or learn-by-trial-and-error variety.
- Because the craftsman is not supplied a realistic goal (time estimate), performance is likely to be mediocre and hard to measure, supervision difficult, and costs out of line. Predicted dates of job completions are likely to be inaccurate.
- Because estimates of costs are not available before work starts, authorization and control of maintenance expenditures may be inadequate.
- Because not all jobs are planned and organized into daily craft scheduling, currently requested work or small jobs are undertaken instead of work most important to over-all good of mill operation.
- Because a measure of work backlog (in crew-days) is lacking, determination of economic crew sizes in each craft may be biased or just happen-chance.
- Because there's no detailed planning prior to a craftsman's assignment, many jobs require special attention from supervisors. Important routines such as preventive maintenance are likely to be neglected.

Clearly, in view of the above, not all the planning should be left up to the craftsman.

How about the foreman? No, because his responsibilities are already spread thin. His main concern should be supervision of his men—assigning them so as to utilize their best abilities, coordinating their work, overcoming delays inevitable in any work situation, inspecting work in progress and completed, controlling the use of materials. He also should be spending half of his working hours training his men on the job and taking care of their personal problems—grievances, questions of pay, vacations, absences, illnesses, and the like. Also he must do any record-keeping that may be thrust upon him.

If the foreman is to do any detailed planning on the jobs assigned to his craft, he must be responsible for very few men—ten or fewer. But when a supervisor has to coordinate more than four or five foremen, problems pyramid and effective management is difficult if not impossible without planning.

Better way to plan—Thus the case for staff planning builds up. Good detailed planning on each job results in fewer emergency reassignments, less frequent interruptions, and less general confusion. Morale, job satisfaction, and craftsmanship are enhanced.

There's nothing that can crush a worker's interest in a job so much as interrupting the job with reassignments. Foremen know this and normally do their best to plan ahead. But in the profusion of jobs in most maintenance organizations, planning is the activity most likely to be put off.

It's not so much a matter of putting the most important things first. In practice a foreman must take things as they come. Records, worker discipline, and direct requests of craftsmen can't conveniently be delayed. They must be handled as they come up. Something has to give, and it's usually planning.

Even though it's expensive, you can start a job without adequate planning. Often it's even easier on the foreman to plan as work progresses. But it seldom yields the best over-all results. A planning staff can flexibly spread its time over many jobs according to the payoff of planning each job. But the line must gage its planning time according to time needed for the job. The result is that the ratio of planning to working time is not consistent among all maintenance jobs.

The conclusion: Responsibility for much of maintenance planning—and, by the same token, scheduling—falls into a staff function, almost by default. The staff can multiply the effectiveness of the line organization by concentrating on important tasks for which the line has little time.

Where planners report—This question revolves around another question: For whom are the planners planning and the schedulers scheduling? If the planning staff is planning both electrical and mechanical work, it should not report to either of these supervisors. To do so would place one supervisor in charge of planning the other supervisor's work.

The mechanical and electrical supervisors could have separate planning staffs. But this arrangement would be weak in coordinating the two groups and their work. It would also accentuate peaks and valleys in each group's workload.

I vote for the maintenance manager, who has total responsibility for producing results in maintenance. A function as important as planning should report directly to the man with responsibility for results. The maintenance manager can't use the planning tool to best advantage if it reports to somebody one or more echelons below him. Planning and scheduling is not just a service to maintenance foremen. It's also a control on the work supervised by foremen and supervisors. To be an effective force in controlling maintenance, planning and scheduling should be on a par with maintenance supervisors, as we have shown in the maintenance organization chart (page 112).

METHODS ENGINEERING

Should the industrial engineering department that works on production methods be concerned about maintenance methods? Or should the maintenance department take care of its own methods improvement?

The techniques in improving repetitive maintenance

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"Only way to improve maintenance is to compare

methods are the same as those applied to production. If you have an industrial engineering department serving production, you can extend its efforts to maintenance. Recommendations are likely to be more objective when they come from a staff that makes plant-wide recommendations. If the industrial engineering work is plant-wide, it should report to the plant manager, not to production. You must be consistent in assigning responsibility and authority.

Studying maintenance jobs—If your plant organization doesn't include an industrial engineering department, you can assign methods studies to the maintenance engineering section. It takes a lot of uninterrupted time to study maintenance methods. You must study not only repetitive maintenance jobs, but also the repeated elements of work that occur in all maintenance jobs (screwdriving, nutrunning, hammering, sawing, pipe threading, etc.). It's not the kind of work for a catch-as-catch-can assignment.

True, foremen and craftsmen can improve details in work methods, especially if there's a work-simplification program to help them. But these "doers" have little time to make broad studies or keep informed on methods that will result in maintenance innovations such as improved procedures, work measurements, and incentives.

If your maintenance function is a large one, a separate industrial engineering section of the maintenance department may be the best solution. In any case, responsibility for improving maintenance methods must be considered as a collateral responsibility. Foremen and craftsmen are very much a part of the best methods-improvement programs. Indeed, most of the improvements may come from them. But you can't afford to assume that the line portion of your organization will have time to develop *all* the means of doing better maintenance work. Therefore, you should establish the responsibility as a staff function.

PREVENTIVE MAINTENANCE

Let's define the work involved before organizing it. Once you understand the function, organizing it is easy. Laying out the original preventive maintenance (PM) program takes time. Analysis of repair histories and inspection reports to expand PM practices is also time-consuming. It requires a detached, analytical attitude and an engineering understanding. Laying out the program is a staff activity that can be attached to maintenance engineering.

Scheduling PM work, however, is a natural extension of over-all planning and scheduling. If you want to use your maintenance man-hours most effectively, you should assign all scheduling to one group. To schedule PM work separately would mean conflicts.

Supervision of PM work (inspections, lubrication, corrective repairs resulting from inspection) is the job of maintenance foremen. In other words, line and staff have collateral responsibilities toward a PM program. Each group does that part of the program for which it is best prepared.

WORK MEASUREMENT

Where are maintenance labor standards most effectively developed and applied? Here we have two problems: development and application:

- Developing maintenance labor standards is one thing. It requires the same skills and knowledge as developing production standards. Slightly different techniques are required to develop task times that can be applied to a variety of maintenance jobs. It's a problem of separating out all the recurring tasks in non-recurring jobs. But once the problem is understood, the industrial engineering department—whether plant-wide or a maintenance staff—is well equipped by experience to develop maintenance labor standards.
- Applying standards is another matter. Production work is highly repetitive, compared to maintenance. You can set a production standard and use it for months—even years. In maintenance work most jobs recur so seldom that you have to set a "rough" standard for each job according to the tasks involved. In other words, planning and estimating are practically inseparable. To plan a job in one place and set the standard in another would involve duplication of time and effort.

If the maintenance department is to do maintenance work planning, then it should also apply maintenance labor standards. An exception to this could be highly repetitive maintenance work such as janitorial and lubrication routines.

Developing standards—Where the maintenance planning staff can develop its own standards, the logical solution is to create an industrial engineering section right in the maintenance planning staff. This is especially true when standards have to be "slow grown"—that is, when a work-measurement program is to be developed over a period of many years and applied to a limited extent during the time of development.

What do you do if the plant industrial engineering department is the only source of skills to develop the maintenance labor standards, and the people involved are best left there? You then must plan to coordinate development and application of the maintenance standards. Certainly the people who should eventually apply the standards must have a hand in developing the standards if they are to apply them intelligently.

Assigning a maintenance planning-and-scheduling man to the industrial engineering department on a temporary basis to assist in developing standards might be the answer. Other possibilities will present themselves in a particular organization. The point is, by identifying the major objectives you can devise the best organization to fit your case. Then around this framework or organization you can work out procedures—and methods—to overcome the minor problems.

Developing or applying work standards is not a logical duty of the people who do the work. Foremen can estimate the time required to complete maintenance jobs. They can also be required to compare craftsman time with their estimate. This is an incentive to improving work, not a work control. For if performance times

what's happening with what should be happening"

don't agree with foremen's estimates over a long period of time, the estimates will be increased rather than performance improved. Only with realistic estimates can you consistently judge the true reasons for poor performance. Only with realistic comparisons of what is happening against what should be happening can you get consistent major improvement in performance of your maintenance work.

How can you know what should be happening? Don't expect men to appraise their own work. Organize a staff group to do it. Size of this group depends on size of the maintenance force and the basis of work measurement. Therefore you need to select this basis carefully, so the cost of refinements of one method as against another will be justified in extra savings.

MAINTENANCE STORES

In most plants the cost of maintenance materials runs from two-thirds to one and a half times the direct maintenance labor cost. It takes good management to control it. The delegation of responsibility is complicated by problems such as these:

- What materials should be used on a job?
- How much material should be used on assigned work?
- Of the materials that are used, which should be carried in stock?
- How much should be kept in stock?
- When should the materials be re-ordered?
- From what vendor should they be re-ordered?

Different people in the plant organization are best prepared to answer these and other related questions. Maintenance foremen are in the best position to determine what materials their men should use and how much is reasonable for the work being done. Where material specification is critical or different from accepted practice, maintenance engineering can specify. But the point of control in use of materials is right at the point of use. In most plants the foreman supervising the work is responsible for controlling material used by his men.

Determining what material and how much of it should be carried in stock depends upon amount of usage or (in the case of spare parts) how much it will cost the plant if the material is not in stock for any emergency repair. You can keep records of material usage anywhere. But estimating the cost of not having materials, the decision on alternate repairs, and the chances that a repair will be needed are best understood by the maintenance manager and his people. As long as they are objective and unbiased in their analysis, maintenance people can prescribe the best value analysis of the materials maintenance uses.

Controlling stores—The maintenance manager is the point of foremen's pressure for everything they need. He may yield to the foremen's natural desire to keep plenty of everything. Concern over this possibility has led some managements to place maintenance stores under purchasing or accounting. Value analysis by either of these groups is difficult. Much of the information on how critical a material may be is impossible to express in measurable terms.

The maintenance manager must supply all the information that's used in value analysis of maintenance stores items. If the purchasing or the accounting department uses this information only to minimize inventory consistently, the cost of operating and maintaining plant equipment will be excessive. Because these departments lack first-hand knowledge of the problem, stores may be cut to the bone. Then production may be delayed for lack of spare parts. Or maintenance may have to resort to substitutes or makeshifts that will cost far more in the long run.

Maintenance stores inventory investment can be controlled by using accountability reports. You can determine par for your inventory by setting scientific minimums and using an economic-order-quantity formula according to the turnover and price of each item in inventory. With these management controls in effect, you can safely give the responsibility of maintenance stores to the maintenance manager. This follows the accepted sound principle of assigning the total maintenance responsibility to a single man. Only when personalities conflict or inventory control is lacking should maintenance stores report to anyone other than the maintenance manager.

Should stores people order materials from vendors? Or should the purchasing department order materials for maintenance as well as for production? You can gain substantial savings by intelligent purchasing. It's the purchasing department's business to know markets, vendors, and price trends. This department should be in the best position to buy maintenance materials as well as production materials. You can hold an independent purchasing department responsible for buying materials that are specified by your maintenance people. It also can perform part of the maintenance-material control function if you spell out definite responsibilities that do not circumvent or hamstring the responsibilities of the maintenance manager.

We haven't yet discussed the details of a stores staff. We don't need to. Once you've established the responsibilities for control, the duties of storekeepers, handlers, and clerks automatically fall into place. If you realize the economic importance of the stores function, you won't withhold adequate manpower to staff it. In fact, this maxim applies right down the line to any maintenance staff function that will improve plant profits.

- **Postscript.** Don't get the idea from these pages that good organization works by itself—that once you start it up, it will run on its own. A perfect cutting tool still needs the hand of a skilled craftsman to guide it over the work contours. A perfect organization still needs the art of managing to adapt itself to the varieties of shop demands. A good manager can twist a good basic organization a hundred different ways to get the best out of his people.

So don't ever expect a cut-and-dried organization to solve the problem alone. It needs the art of management to make it click.

How to Use Work Sampling Today in Your Plant

Type of work	Example	Common measurement technique	Typical unit of measurement	
Non-standard production work.	One-of-a-kind job shop.	Supervisor's estimate, historical cost records.	Man-days, or total shop force.	
Non-standard service or "indirect" labor.	Shipping, tool-room, etc.	Supervisor's estimate, historical cost records, or demands of production (at least one crane operator per shift, for example).	Man-days, number of men per shift.	
Technical and shop clerical.	Engineers, production clerks.	Supervisor's estimate, past history, custom.	Number of men, or man-days.	
Office clerical.	Any office function.	Supervisor's estimate, custom.	Man-hours, number of people.	
Fairly well standardized work, irregular demand.	Routine maintenance, set-up men, handlers.	Standard data to cover work, historical records for demand pattern, supervisor's estimate.	Man-hours.	
Standardized work, scheduled production.	Direct production labor.	Time study or predetermined work times, usually reduced to standard data.	Standard hours or minutes per production unit.	

WORK SAMPLING TODAY

It has come a long way in its 7-year life—new uses, new refinements that every plant executive should know about. Here Wallace Richardson (co-author of the book "Work Sampling") updates you on the state of the art—shows how it can be more useful than ever before and why it's indispensable in your plant.

SEVEN YEARS ago, in July 1952, FACTORY first introduced work sampling. It was a brand-new tool for plant management men.

What have plant men been doing with work sampling since then?

Are there new ways to use it?

Are there new uses for it?

The answers to these questions are: Plenty. Yes. And yes.

Why has work sampling caught on so well? Because it can measure large elements of factory cost that are difficult and costly to measure by other methods. Because it produces results that are understandable—as well as useful—to management.

By WALLACE J. RICHARDSON
Professor of Industrial Engineering
Lehigh University, Bethlehem, Pa.

WHAT WORK SAMPLING IS

If work sampling is new to you, let's review what it is.

Several years ago I wrote a definition that still fits work sampling as practiced today. Here it is:

"Work sampling is a measurement technique for the quantitative analysis of non-repetitive or irregularly occurring activity, where no complete method and frequency description is available.

"It is also an extremely useful device with which to make an inexpensive over-all survey of office, shop, or service activity. Such a preliminary study can help evaluate the need for further study, and it may serve as a benchmark for managerial purposes.

"Because it is extremely convenient, possesses known reliability,

—Whatever the Work Is

Typical measure of production	Suggested use of work sampling
Jobs completed—usually not further analyzed.	As a first step in getting some control over costs. Also good for continuous control.
Usually related to shop direct labor cost, or number of units.	As a first step in personnel and equipment utilization. Must be correlated with production index for control.
Number of jobs, dollars' worth of work, number of direct labor on job, etc.	To analyze activity and assign costs. May be as detailed a technique as will ever be needed.
Volume of business, number of forms, checks, etc., processed.	As first step. Often no other technique need be used. Can be done by a supervisor.
By particular job, work request, etc.	Excellent to establish over-all utilization. Good for continuous control. Can be used with standard data to plan and control.
Number of parts worked on, number of units produced.	Excellent for time-study allowances. Not very good for setting basic time standards.

and operates without recourse to the stopwatch or subjective judgments of effort or performance, it seems to be very well assured of wide adoption in the future."

WHY IT'S USEFUL

Work sampling has proved most useful in measuring maintenance, material handling, clerical, service, and technical costs. Granted, use of the technique is not limited to analysis of these costs. But such indirect costs usually represent the greatest potential savings in plant operation because they have been subjected to the least control. Much of this work is non-cyclic. Methods have not been standardized. And the work is marked with the tradition of individual craftsmanship. All this has continued to make indirect labor the last area to be standardized or measured. Alert managers have seized upon work sampling as an economical tool to cut costs. (FACTORY's survey, "Work Measurement and Wage Incentives," April 1959, supports the author's observations of this trend—ED.)

Management saw in work sampling the way to answer some increasingly serious problems:

1. Indirect and service expenses—The growing proportion of white-collar and service personnel in the total labor force started searches for new approaches to cost control.

2. Equipment utilization—Capital investment per employee in plant and equipment has been rising rapidly. More firms now build into their equipment-authorization procedures some sort of economic-justification analysis based on return on investment. Wider use of automatic devices has placed more demands on maintenance and planning. All these have led to wide use of work sampling to establish facts on use of men and machines.

3. The growing acceptance of statistical techniques as part of a manager's kit of tools—As more qualified men employ statistical techniques to analyze plant operations, management is becoming more accustomed to rely on them. And increased use is bringing greater confidence in their effectiveness.

WHERE IT'S USEFUL

First let's define the place of work sampling in the general practice of work measurement.

The activity of men and machines can be measured many different ways. These range from rough estimating to detailed analysis by stopwatch or predetermined work times. The same technique can be used to measure different types of work. So what is "right" for your company may change from year to year, or as your operations change, or as company-union agreements change. It's more important to match the technique to these changed circumstances than to hold onto traditional concepts.

In the table at left types of work are matched with the usual measurement techniques. To use this table you should ask these questions:

1. How much of each type of work do we have in our plant?
2. To what degree is each measured and controlled?
3. What is the potential saving through better control of labor and equipment cost?
4. Can work sampling help, considering one area at a time?

Work sampling is especially useful for first analysis of work that isn't standardized, or where methods descriptions and frequency-of-operation elements are sketchy. Most plants extend their application of standards gradually. Some work may never be standardized.

Don't make the mistake of first trying to apply a technique such as stopwatch time study directly to an activity such as maintenance. You'll find it better to start with work sampling, then follow with more detailed techniques. By the same reasoning, don't try to use work sampling to bail out a poor stopwatch time-study system. Work sampling can be used to set detailed time standards. But it's not as effective as time study, predetermined work times, or standard data.

The growth of work sampling, then, can be attributed to the fact that more people feel the need for gross measurement of activity in

12 steps to Success in Work Sampling

1. Set your objective—This consists of two steps: Examine the problems and records to establish the need for work-sampling measurement. Then convince managers, supervisors, and operators that the facts should be gathered by work sampling.

It's not irresponsible to suggest, "Let's give work sampling a try." Why? Because work sampling doesn't commit management to specific further action. And because it helps see the problem correctly. Most problems come to light because some quantitative measure is out of line. If a problem can be solved by work sampling, selling it is easier. Acceptance is necessary. You must persuade people that work sampling is the thing to use.

2. Agree on measures of output—Do it before you start your study. Units may be tons shipped, dollar volume in a shop, number of projects in engineering, or some other expression of output. This way, you'll avoid disagreement about use of the results. Most industries have cycles—yearly or monthly. If you can relate results of a study to relative level of activity during the study, you can plan and predict. But do it ahead of time.

3. Train personnel and announce the study—In general, managers, supervisors, and the people who will be studied must have advance notice and must be made aware of purposes and procedures. The study director usually is an engineer or supervisor with initiative to attend to details and with personality to sell, explain, and help initiate action. Observers may be engineers, time-study men, supervisors, or special samplers. The important asset in observers is knowledge of the work situation. You can train anybody in observation.

4. Classify activities into categories—Categories should be consistent with the end use of the study. They should have basic activities that are observable. (You can get supplementary data by questioning.) And they should match accounting classifications, job-evaluation descriptions, or similar data. This way, you can make audits, check results.

5. Design the forms you need—Tailor them carefully. No one form can serve every study. Write your category descriptions. You may use punched cards for recording data.

6. Randomize times of observation—Do this to ensure validity. Usually a table of random numbers is used to randomize observation times. Be sure observers stick to random times.

7. Decide on number of observations—To do this you must find the degree of reliability required. You don't need studies of several thousand observations for all purposes. Today's trend is toward studies of fewer than 1000 observations for spot analysis. Where you feel there's a monthly cycle, you should sample over the entire month. There's no general rule. The study will determine the reliability necessary—hence the number of observations.

8. Take a short test study—Better take a day or two for it. It will validate the categories, settle details of observation, accustom those under study to being observed. Also you can get a good estimate of the category proportions to use in reviewing the plans. Usually you don't include the pilot study in the over-all results.

9. Set up simple clerical procedures to process results—You must get results back to line supervisors quickly. If the data are fresh, supervisors will pay more attention to using them. Tabulating or edge-punched cards will help.

10. Use a control chart—Where it's appropriate, that is. Generally, where you think a work situation is fairly stable but you want to know if unusual activity takes place, a control chart is useful. In work sampling, though, you usually don't use three-sigma (99.7%) confidence limits. Two-sigma (95%) limits are more realistic. By setting such limits about $\bar{p}$, you use the concept of management by exception. Also you can audit over-all performance and determine when a work situation warrants a change in manning. Principally the control chart will show progress and avert misinterpretation of results. In other words, you won't be chasing trouble where there isn't any trouble.

11. Keep a file of each study—This way, you'll avoid "inventing the wheel" every week or so. In multi-plant operation such a file is essential. Categories of activity should be consistent among shops. So should the mechanics of taking studies.

Another reason for keeping complete records: You may be called on to sell the idea to other divisions of the company, to customers, or to professional meetings. The Northrop Corporation has a team that explains its application of work sampling (and other controls) to others.

12. Develop a follow-up—It's reasonable to suppose you'll start some action as a result of work sampling. Why? Because with work sampling you can check progress. You can take "make-good" studies after changes have settled down, with direct comparison possible. Plan time and extent of follow-up when you make the change. Since work sampling compares a particular aspect of shop operation to the same aspect in the same shop (only change is in time), it's fair to all. Built-in follow-up studies also provide credit where credit is due, establish results objectively.

such areas as maintenance and service. It's not because of any need for additional measurement of direct labor. Work sampling has been a big help in appraising time and money spent in productive and non-productive activities.

HOW IT'S GROWING

We don't have survey data to measure the growth of work sampling. But personal knowledge and experience support these five facts:

1. About two-thirds of all large manufacturing firms use work sampling. These companies are in steel, chemical, automotive, electrical, and electronic equipment industries as well as other fields. Some of the men in these industries have contributed a great deal to developing the technique. Many companies have excellent manuals.

2. Many smaller companies use it. It's equally useful for them, of course. But sometimes they feel they don't have qualified people to apply it. A fair guess is that one out of four small manufacturing firms uses the technique. But use varies from industry to industry.

3. Service industries, such as warehousing, are picking it up. But they're hampered by lack of people who can apply it. Only a few plants in these industries now use it. But use is growing even here.

4. Growth of use is rapid. Within the next three years work sampling probably will become as common as any other management technique. Seven out of eight plants say they've been using it only since 1952. This figure is based on a tabulation of over 200 users.

5. There has been a big shift in the literature. Also in other sources of information about work sampling. Six years ago the emphasis was on describing the technique. Today most articles about it describe new uses or new refinements in application. You can learn to use it—and to improve its use—through published material and through meetings. Most discussions of it assume the reader knows the basic technique. Many management and technical societies include it in their programs. And there are many articles and books about it.

Fact is, these days you can even bring in a consultant to train people. Work sampling is not formidable. True, it's based on statistical theory. But the theory and practices are straightforward and easy to learn, and you don't have to be a whiz at math to use them. Much of the progress in recent years has been in simplification of the math. Success in application depends not so much on ability to learn work sampling as on using it after you do learn how to handle it.

Thus work sampling has earned a place among the useful techniques with which plants analyze and control operations. It is no longer considered new. With it, management has attacked the last frontier of unregulated cost—indirect labor and clerical and professional work.

WHY IT FITS PLANT WORK

Advantages added up—Work sampling brings lots of them. For example, look at these:

1. It's economical to use—usually less than a third of the cost of time study.

2. It's a "do-it-yourself" technique. No experts needed.

3. It measures utilization of people and equipment directly.

4. It does not bring a stopwatch (and need not bring performance rating) into areas where these are not traditional.

5. It provides data over periods of time long enough to put unusual conditions into perspective.

6. It can measure activity even where work is non-standardized and methods are not defined.

7. It can be tailor-made to get information about anything that can be observed.

8. It's an ideal measure of overall performance.

9. It has known reliability. This can be calculated in advance to plan studies.

10. Generally, its use does not commit management to any particular work-measurement coverage or incentive scheme.

11. It enables supervisors to participate. At worst, measurement is more easily understood. At best, the supervisor appraises parts of his own problems.

Limitations added up—There are certain things that work sampling will not do. For example:

1. It's a poor substitute for conventional time study or predetermined work times where work is standardized. Some applications have been reported. But in general work sampling will not replace the conventional techniques in direct labor measurement.

2. It will not give a step-by-step methods description of a job. It will show undesirable "lost motion," but it won't replace conventional methods study for job analysis. One advantage of time study, of course, is that a method description is made as a byproduct.

3. It will not reduce the need for management planning. In fact, it will uncover the weak spots. In maintenance, for example, work sampling will tell you that your people are "non-productive" a certain per cent of the time—even find the reasons. But you must straighten out planning, scheduling, and methods in the same way you now do.

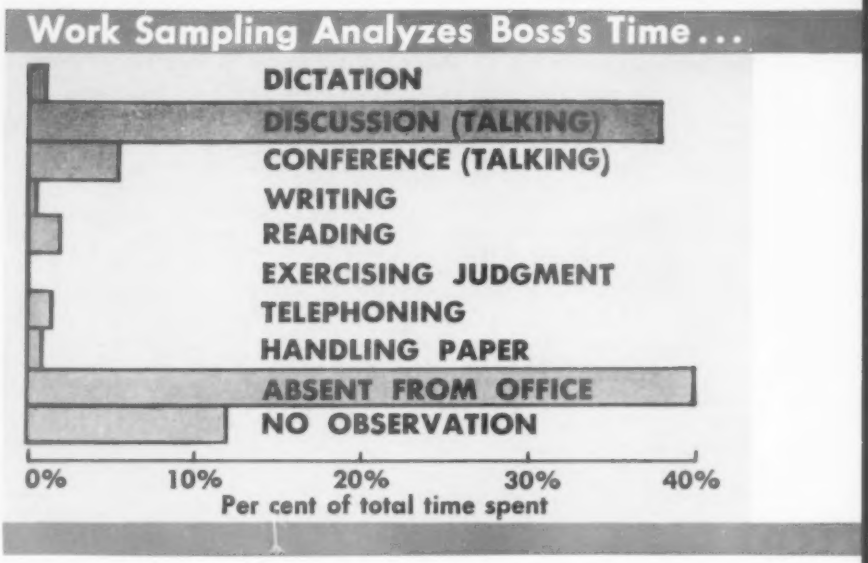
Used properly, then, work sampling has many advantages. Wherever equipment utilization is important, where work is irregular, where a general investigation is needed, or where you're setting rough standards for demand-type labor, you can use work sampling profitably. In a general attack on areas previously not studied it should be the first technique considered. At the same time, conventional techniques of improvement and control become more important when work sampling is used, because you can measure progress. The best criterion to use in appraising improvement is to compare the same jobs before and after. You need an independent measure with which to show whether or not you're getting the planned return. Work sampling gives this.

NEW TRICKS EVERYWHERE

With so many plants now using work sampling, you'd naturally expect some new tricks in application. Here are eight that are picked up from many users:

1. Punched cards simplify data analysis—In big studies several thousand observations may be made. Also, where more than one variable is important, punched cards make analysis easier. For example, you can use them to study different classes of product, conditions of operation, time of day, or type of operator in relation to time. Information in coded form is available

Begins on page 122



from the sampling studies. This is punched into cards from the observation sheets.

In some plants observations are made directly on IBM mark-sensed cards. In others, an IBM Porta-Punch is used. Sometimes a McBee Keysort card. In these last three cases the card is marked or punched directly by the observer.

2. Two-part technique tells "why" as well as "what"—Two codes are used. One describes observable activity, tells "what." The other, giving reasons, tells "why." The observation may be taken from a distance to note what activity—such as typing—is taking place. Then the observer may question the typist to learn and record the specific job being done. The element of instantaneous, random observation is retained, but at the same time it's possible to get more useful information. This technique has helped improve analysis of drafting, clerical, engineering, and service work.

3. Indices of utilization make good controls—Assume your work sampling establishes that painters in a maintenance department are "productive" 75% of the time, pipefitters only 60%. Differences in type of work, amount of waiting for other crafts, degrees to which work is planned, and other factors may be explanations for these productive differences. Over a period of time you can develop indices for different groups—one for painters, another for pipefitters, and so on. When you chart these with output records, you have a basis for control of performance. In other words, you can use work sampling to develop over-all standards of performance without resorting to performance rating or describing work methods in detail.

4. Work sampling is integrated with accounting and cost control—By considering accounting codes when designing studies, some companies have helped the cost accounting department allocate burden (or factory expense). With the trend to direct costing this system is becoming more attractive. For example, the salaries of process-planning engineers may be charged on the basis of dollar volume of each class of product. A work-sampling study can tell how much time these men spend on each class of product, thus help allocate cost more realistically.

5. Work sampling gets facts for quick decisions—Such studies are short, do not have the reliability usually considered necessary, and are limited in number of information categories. But they are in increasing use to answer such questions as "Do we need the extra truck?" or "Can two clerks handle a higher volume?" Even though limited, such studies are useful where the alternative would be snap judgment.

6. Supervisors act as observers—This has proved practical in material handling, maintenance, and service activities. In clerical work the supervisor is usually the best observer. In a shop where an industrial engineer knows the people and the jobs and is measurement-oriented, the situation is different.

But usually engineers aren't assigned to office or service operations. Therefore the supervisor may be the observer. The objection that is sometimes raised—that he would not reveal undesirable conditions—has largely been overcome by sensible use of the results. It's more likely that the shortcomings will be in management planning than in work habits. Several maintenance departments and almost all offices that have tried work sampling have used supervisors as observers.

7. Sampling by zone measures work that covers large areas—In some plant operations, such as material handling and maintenance, the people or equipment to be sampled work over a wide area. They can't be expected to stick to a fixed route. For these, rather than spend time hunting a man or a truck, you can sample by zone and note the activity of those in each zone. Summary of the observations in all zones gives the same results as a normal study. Of course you should take care to get enough observations.

8. "Fixed interval" technique is used for group studies. I. Landis Haines (Lukens Steel Company, Coatesville, Pa.) made studies where the interval between observations was constant and of the order of two or three minutes. The observer remained on the scene. Those observed could not tell exactly when the observation was being made. Most important, the work itself was random. The technique is excellent for studies of groups of workers, multiple-equipment studies, and audits of a group-measurement plan. Also it allows performance rating only under limited conditions. But in this method the observer is constantly at the workplace, he is qualified to rate or level, and the people are used to being rated. Further, the rating of performance is pertinent.

NEW PROBLEMS TO SOLVE

Newest applications of work sampling are aimed at easing professional and executive problems. Too much time of engineers and executives is spent on matters beneath their talent level. It's a touchy

. . . and Breaks Down His Talking Time

FUNCTION	NUMBER OF PEOPLE	NUMBER OF OCCURRENCES	PER CENT OF TIME
ADMINISTRATIVE	8	53	10.8%
PRODUCTION ENGINEERING	7	64	13.2
PRODUCTION CONTROL (PLAN AND EXPEDITE)	5	86	17.7
INSPECTION	3	23	4.8
MANUFACTURING DEPARTMENTS	14	128	26.5
MAINTENANCE AND CONSTRUCTION	3	28	5.8
STAFF	12	40	8.2
ACCOUNTING	3	10	
PURCHASING	2	6	
PERSONNEL AND SYSTEMS	2	5	
SALES	3	5	
ENGINEERING	2	14	
SECRETARY	1	16	3.3
UNION AND INTERVIEWING	3	27	5.6
OTHERS (INCLUDING NO NAME)	2	20	4.1
TOTAL	58	485	100.0%

problem to fool with. But work sampling can provide you with the facts on which to base changes.

In answering the question, "What's new in work sampling?," C. L. Brisley (staff assistant to director of production, Chance Vought Aircraft Company, Dallas), who wrote FACTORY's first major report on work sampling (July 1952 issue), writes as follows:

"In my own experience the newest use of work sampling is on management personnel (FACTORY, December 1958, page 60). Up to now, this area has been little explored by any work-measurement technique. One of the striking revelations of this study is the need for greater efficiency in oral communication. From 80 to 85% of a manager's time is consumed in talking, talking, talking. There is evidence that more 'plan ahead' time is required to bring about greater effectiveness in meetings, discussions, conversations, telephone calls, and dictation. Management personnel do not spend enough time writing what they plan to say.

"Work sampling shows the need for management work measurement. Such application, coupled with the determination to improve management performance, will improve decision-making and policy-formulation practices. This objective can and will materialize when management is willing to subject itself to the same scientific management techniques that it believes should be applied to subordinates.

"Also we have used work sampling technique to show how to increase the productivity of people performing creative work—engineers, designers, scientists, and planners. Thus we have eliminated menial tasks and allowed each person to focus his experience on the problems he was hired to solve."

Engineers analyzed—Brisley's suggestions do not represent isolated opinion. With the cost of engineering going up and up, many efforts have been made and are being made to study this type of work. Work sampling has been successful in this analysis. In 1955 a check study showed that the equivalent of 11 draftsmen and designers has been added to the force by improving employee effectiveness. This study was notable because supervisors acted as observers and because two-part observations were used.

Executives, too—Another interesting work-sampling study of management was made by C. K. Reller (now of the engineering department, E. I. duPont de Nemours & Company). The charts above show the results of the study of the executive vice president in a medium-size instrument manufacturing company. From the charts you can see that the executive spent most of his time in discussion and in conference. In a month's time he saw 58 plant people. He had very little time to himself for planning—or for anything else. Of course, he was "exercising judgment" constantly. But the charts show that he spent no time at his desk alone. No wonder executives always carry loaded briefcases when they go home.

The second chart illustrates the use of the secondary-observation technique. It shows *why* he was in discussion or conference.

Statistical frontiers—John M. Allderige (Eastman Kodak Company, Rochester, N. Y.) is a leader in developing better work measurement. He has combined work sampling with queueing theory and regression analysis to refine indirect labor standards and demand-labor situations. As an indication of the acceptance of work sampling and the more sophisticated mathematical approach, Mr. Allderige says: "Four years ago people used to ask me about sample size in a work-sampling study. Now they are discussing multiple-regression."

The trend John Allderige notes seems to be a strong indication that new uses for statistical tools are being recognized. My own experience has been that use of operations-research techniques is limited only by the basic information available to formulate and solve problems. Work sampling, especially in the form of special studies, can help supply needed information.

Finally, work sampling offers an ideal means of introducing statistical techniques in general—and sampling of all kinds in particular—into an industrial organization. There are many advantages to the effort. Work sampling introduces certain basic statistical concepts, but it's easily understood at all levels of management. Successful applications of work sampling will contribute much to opening the door for the use of the more advanced techniques of operations analysis that are sure to be more widely used in the future.

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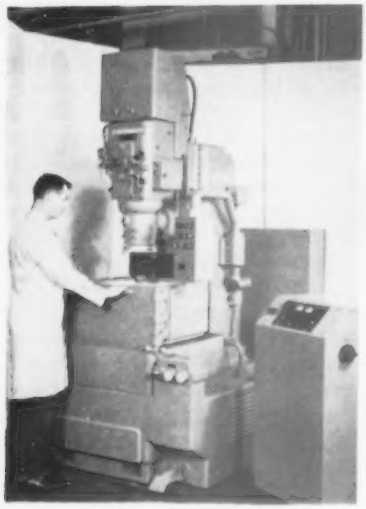

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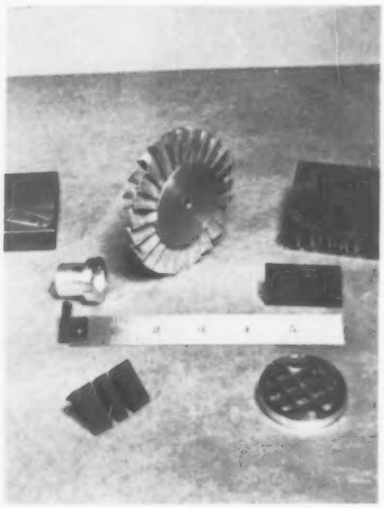


AND PARTS YOU CAN FORM WITH . . .

Tools for Electrospark Machining

The electrospark method of metal removal has "come of age." Electrojet line of standard tools performs any removal job to obtain any shape or geometry without affecting structure of workpiece. For "unmachinable" die materials, this machining method stands alone.

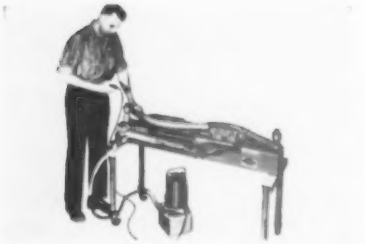
This line of 33 "building block" components consists of a basic base and column. On this may be mounted four interchangeable workheads and four different base-tank units. Workheads are non-rotating for die-sinking operations; rotating for revolving electrodes; universal to produce precise holes; ram-type for extra large plunging cuts. You can get close tolerances to ±0.001-in. accuracy, or better. You can machine cavities of 50 cu. in. at metal removal rates from 0.016 to 0.018 cu. in. per min. *Cincinnati Milling Machine Co.* (Circle 101).

102—Conveyor Lubricator, with Universal head, works with trolleys of various makes on same conveyor. Automatically discharges oil or grease into wheel bearings. Mounted on trolley rail, lubricator is set off when trolley wheel engages nozzle of pumping unit. *J. N. Fauver Co.*

103—Magnetic Conveyor Control provides selective dispatching of carriers to as many as 64 receiving stations. "Maitrol" system uses magnetic address tabs at central dispatching and receiving stations to direct automatic discharge of carrier. *Maico Electronics, Inc.*

104—Ultrasonic Cleaner has two separate Pyrex glass beakers for washing and rinsing small parts simultaneously in two different solutions. Good for parts such as gears, relays, etc. Low-cost—uses no more power than average electric light bulb. *Narda Ultrasonics Corp.*

105—Pneumatic Vibrator Table gives proper amount of vibration by simply adjusting air pressure. Useful for settling, packaging, shock- or fatigue-testing, or scale removal on castings. Requires little maintenance due to one-piece construction. *National Air Vibrator Co.*



106—Pipe/Conduit Bender makes accurate offsets and full 90-deg. bends, close to the end of ½ to 2 in. pipe, with one setting and ram stroke. Forms angles between 90 and 180 deg. Develops 15 tons of ram pressure. Portable; hand- or power-operated. *Greenlee Tool Co.*

107—Ratchet Wrench turns nuts and bolts faster and easier. Complete wrench line, in six sizes, comes with 6- and 12-pt. openings from ¼ to ⅞ in.—accurately broached to assure proper fit. Critical parts of alloy steel are heat-treated for long life. *J. H. Williams & Co.*

108—Add-Print Tape Punch serves as adding machine while simultaneously perforating data on paper tape. Doubles as high-speed entry device for EDP applications—for example, as input for numerically controlled machine tool system and inventory control. *Clary Corp.*

Turn the page

REPORTS *on concrete bonding with* THIOKOL *LP/Epoxy compounds*

TEST OF STRENGTH. Concrete beam broken in flexure was then cemented together with a Thiokol LP/epoxy adhesive. Broken a second time, beam failed at point other than the adhesive line. Adhesive stands up though concrete gives way.

#1 *Repairing concrete with adhesives that cure* STRONGER THAN CONCRETE

Through extensive laboratory and field tests, concrete adhesives based on THIOKOL liquid polymers have shown outstanding strength in a wide variety of applications . . . bonding both old-to-old and new-to-old concrete.

They have successfully met the challenge of time, temperature and wear in repairing spalled and scaled areas, broken slabs and cracks . . . in securing cement overlays . . . in skidproofing and sealing . . . and in bonding traffic markers to both cement and bituminous concrete surfaces.

State, municipal and private groups have found in THIOKOL LP/epoxy adhesives a satisfactory solution to many problems of maintenance and repair of highways, buildings, sidewalks, floors. Chances are, you will, too.

FOR FULL INFORMATION: Mail Coupon to Dept. 3, Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J.

Gentlemen: Please send me available data on THIOKOL LP/Epoxy adhesives for concrete repair.

Firm_____

Street_____

City_____ State_____

Your Name_____

Thiokol®

CHEMICAL CORPORATION

780 NORTH CLINTON AVENUE • TRENTON 7, NEW JERSEY

In Canada: Naugatuck Chemicals Division, Dominion Rubber Co., Elmira, Ontario

®Registered trademark of the Thiokol Chemical Corporation for its liquid polymers, rocket propellants, plasticizers and other chemical products.

For more about these items, circle numbers on Reader Service Card next to back cover.

EASY-TO-CLEAN TRAYS LAST LIFETIME IN PINT-SIZED . . .

"Building Block" Cooling Tower

Plastic drip trays fashioned into "building blocks" (decks) make possible this light, small, easy-to-service outdoor-type Econ-O-Mizer cooling tower. Compared with conventional towers, this plastic deck construction has saved up to 50% in over-all space and weight.

A few of the high-impact polystyrene trays fasten together to form a block. They can be removed and replaced easily and quickly for cleaning and maintenance. Each tray, with over 600 drip spouts, is staggered to allow water to pass slowly downward from one to another in a precise pattern. Close control of drip pattern and air flow assures maximum contact between air and water. This efficiency results in high-capacity cooling and a small-sized unit. Plastic eliminates rotting, fungus growth, warping. *Acme Industries, Inc.* (Circle 109).

Pencil-In Your Own Processing Program

Now you can chart your own process program. This automatic process controller permits a change of program simply by erasing and redrawing part of graph. You pencil in the program directly on recording chart. Device "reads" program, controls process accordingly, and recording pen charts actual performance. Any deviation between drawn program and actual performance is immediately corrected. *Research, Inc.* (Circle 110).

111—"Snap-on" Socket has removable and replaceable magnets in ¼- to 9/16-in. sizes. Now expensive magnet can be inserted into new socket when old one wears out. Special assembly tool transfers magnet quickly and easily, and gets it to proper depth. *Snap-on Tools Corp.*

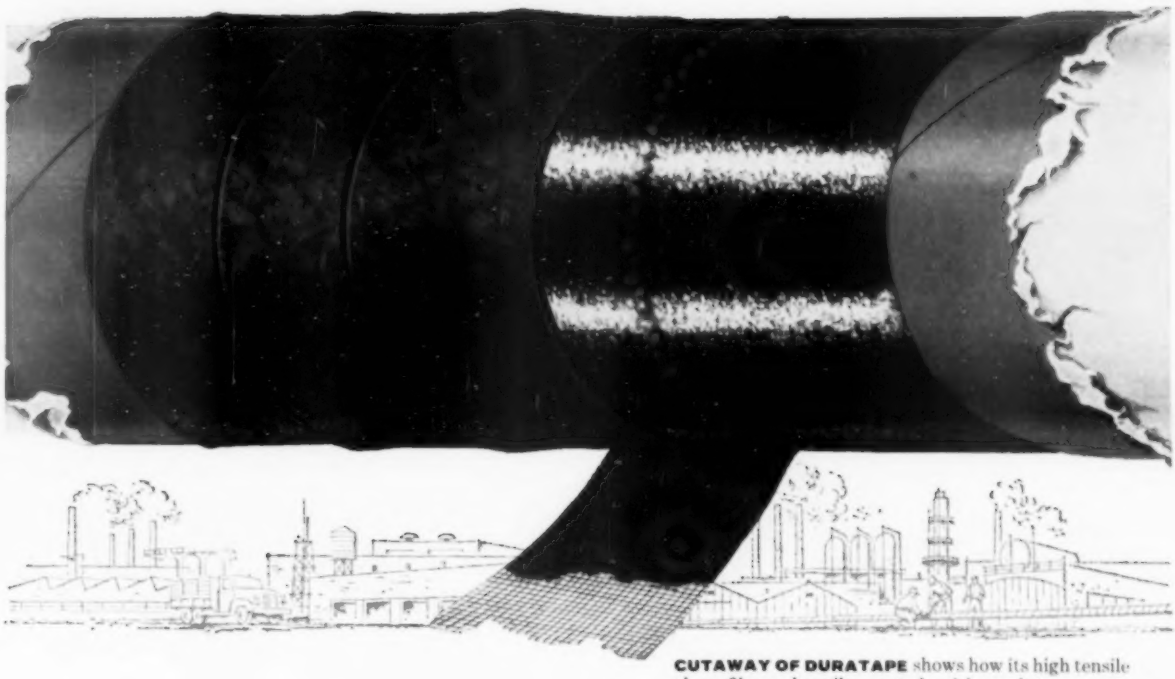
112—Transformers, power and distribution, are available in both ventilated and sealed dry and liquid-filled types. Dry-type ratings to 3750 kva., voltages to 15 kv.; liquid-filled ratings to 12,500 kva., voltages to 69 kv. Double-welded tanks. *I-T-E Circuit Breaker Co.*

113—Recorder-Controller combination saves valuable panel space. Offers more flexible control up to 6 points and recording up to 24 points. Operates from one or two separate thermocouples or other inputs per point. Has "on-off" and electric control. *Daystrom, Inc.*

114—Rubber Expansion Joint, spool-type, withstands repeated flex without setting, cracking, or fracturing. Three types: for pressure, vacuum, and combination. Fits pipes from 2 to 72 in., for pressures to 125 psi. Eliminates need for sealing gasket. *Mercer Rubber Co.*

115—Airless Paint-Sprayer produces wide spray pattern without excessive mist and rebound, thus minimizing exhaust requirements. Gives sharp edges, heavy and even coat. Has single fluid hose for hard-to-reach areas. Uses 1800 to 2400 psi. *DeVilbiss Co.*

Turn the page



CUTAWAY OF DURATAPE shows how its high tensile glass fibers, heavily coated with coal tar or asphalt, provide an extremely durable dielectric shield.

Mill-wrapped pipe lasts only as long as its joints . . . that's why

more and more companies use Johns-Manville Duratape® to protect pipe joints

QUICK, EASY APPLICATION. Simply wrap primed joints with Duratape . . . flash-seal with low-temperature torch during and after application. Wrap can be similarly applied to elbows, tees and other pipe fittings.

J-M Duratape Joint Wrap is designed to give pipe joints the kind of protection they need to live as long as the rest of the pipe. It forms a tough dielectric barrier with excellent resistance to corrosive elements.

Made of high tensile glass fibers, and heavily coated with coal tar or asphalt, Duratape forms a tight bond with the pipe and a lasting seal against corrosion. In many years of actual use, this combination of inorganic glass fibers with coal tar (or asphalt) has proved to be far superior to organic base tapes.

Duratape is also fast and easy to install. This, plus its initial low cost, permits extensive savings on joint-wrapping. No problem with tearing, either, because of its strong, reinforcing glass fibers.

Your nearby Johns-Manville representative has samples and complete information. Contact him, or write to Johns-Manville, Box 158, New York 16, N.Y. In Canada, Port Credit.

WHEN ORDERING mill-wrapped pipe, be sure to specify the J-M "Partners in Pipeline Protection"... Blue Flag® Fiber Glass Wrap for enamel reinforcement with an outer shell of J-M Asbestos Felt . . . for *complete* pipe protection.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

For more about these items, circle numbers on Reader Service Card next to back cover.

116—Outdoor - Indoor Vacuum cleaner picks up anything from paper and sweepings to lost coins and leaves, wet or dry. To move machine, operator pushes or pulls it; throttle control on handle regulates speed and suction. No exposed moving parts. *Musgrave, Inc.*

117—Aluminum Casters are designed for applications where corrosive conditions prevail or where casters are left standing outdoors. Light-duty 5- and 6-in. units have sealed bearings and 2-in.-wide neoprene tread wheels. No dirt-catching cracks or projections. *Bassick Co.*

118—Air Drill, ¼-in. size, is slightly longer than fountain pen, yet develops up to 4500 rpm. at 90 psi. In five speeds with either lever throttle or pistol grip handle. Has 3-jaw drill chuck designed to last lifetime of drill. Weighs only 1½ lb. *Ingersoll-Rand Co.*

119—"Staticator" detects and warns of static electricity in a potentially explosive area. Wall-mounted control box sets off buzzer and light when minute quantity of static charge (positive or negative) is present. Counter records number of violations. *Chemetron Corp.*

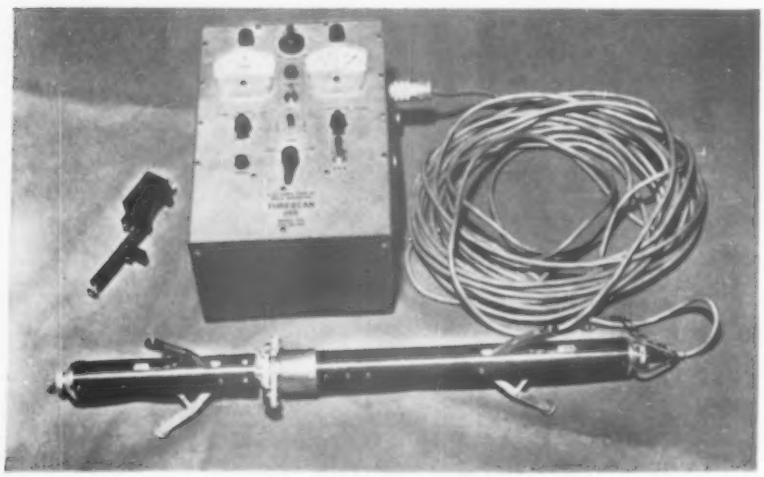
120—Electronic Parts Counter provides accurate count of ⅛- to 4-in. parts of any material of any shape (even paper) at speeds up to 20 pieces per sec. Transistorized unit may be batch-loaded directly or fed by hopper with auxiliary conveyor. *Atronic Products, Inc.*

121—Spraying Gun, on a pole extension, handles fluids such as concrete curing mixtures, roof coatings, steel tank coatings, etc. Simply constructed for trouble-free use under rugged conditions. Air pressure and fluid are controlled by level handle valves. *DeVilbiss Co.*

122—"Roto-Tilt" lifts steel and fiber drums to pour solid or liquid contents. Suspended from a fork truck, it can be safely operated by one man even with heavy 1000-lb. loads. Four models range from 60 to 80 lb., handle 15-, 30-, 55-gal. drums. *Pucel Enterprises, Inc.*

123—Tote Trays have special stops riveted to each end to permit nesting without tight wedging. Also have stacking fixture. Have no sharp metal or wood edges. Lightweight; good for conveyor use; suffer no damage when bumped together. *National Vulcanized Fibre Co.*

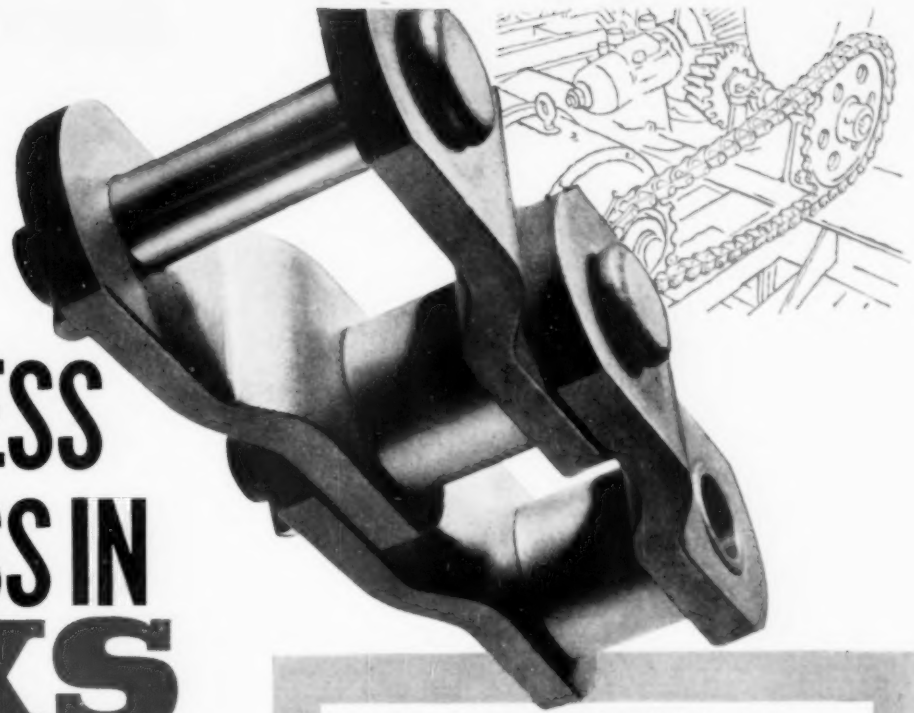
124—Wire-Stripping Tool removes insulated wire from braided shields. Works like a hypodermic needle to eject wire from breakout in shield produced by tube point. Eliminates broken strands. In five sizes for most shielded wires from 30 to 14 AWG. *Technical Devices Co.*



Spots Flaws in Pipes

Pipes and tubes from 2 to 10 in. in diameter get a thorough internal examination with this faultfinder. "Tubescan," consisting of probe with a 100-ft. cable and a recorder, finds and measures defects up to 0.3 in. deep to 0.10-in. accuracy. "Measuring tape reel" pulls probe through piping. When defect is spotted, light signals, probe stops at point, gage records extent and location of flaw. Operates on a 6-v. d-c battery; plugs into 110-v. outlet for recharging. *Union Industrial Equipment Corp.* (Circle 125).

Turn the page



FAR LESS STRESS IN LXS

THE CHAIN WITH NO "STRESS RAISERS"!
Link-Belt LXS brings long-term economy and efficiency to the most punishing drive and conveying jobs. With its "FULL-ROUND" design, LXS has no stress concentration points . . . none of the sharp corners which frequently shorten the life of many ordinary chains.

LXS is available with straight or offset sidebars. For details, contact your nearest Link-Belt office or authorized stock-carrying distributor. (See CHAINS in the yellow pages of your phone book.) Ask for our new, comprehensive Catalog 1050.

They're all of "FULL-ROUND" design

PINS BUSHINGS SIDEBARS

"FULL-ROUND" design eliminates traditional stress concentration points in Link-Belt LXS . . . provides maximum live bearing area between pins and bushings. Result: stress is distributed evenly.

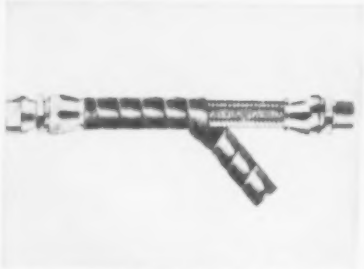
Other LXS long-life features include controlled press fits plus use of selected steels and controlled hardening of all parts. All this contributes to greater uniformity, greater endurance.

LINK-BELT

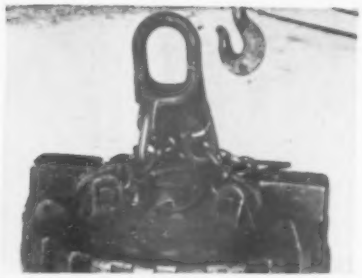
CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15.083

126—Automatic Dock Board, set into 24-in.-deep pit, speeds up truck loading or unloading. Truck sets off controls to raise dock level to horizontal plane of truck bed. Safety feature prevents board from rising if object rests on surface. *Auto-Mechanical Dock Board, Inc.*

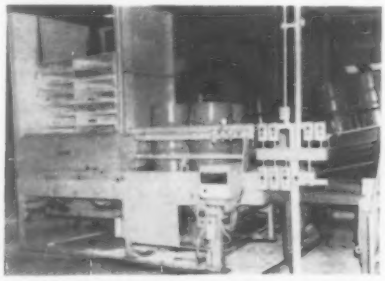


127—"Plastic Coil Sleeve," up to 2 in. in diameter, spirals around lines to protect from air, water, oil, gasoline, etc.; insulates steam-carrying lines. Retains shape and flexibility under −20 to +200 F. Fits any diameter with simple winding motion. *Aeroquip Corp.*

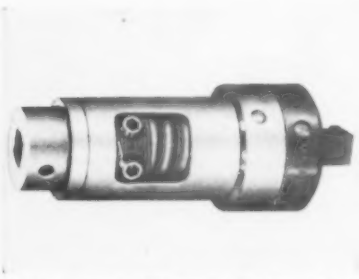


128—Magnet Chain Assembly has rigid master link to permit crane operator to pick up or deposit unit without handling by crane follower or other employee. No more pinched fingers. Tripod construction prevents chain from twisting. *American Chain & Cable Co.*

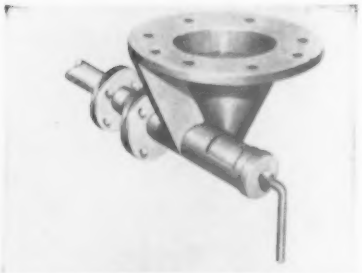
129—Multi-Port Plug Valve, of stainless steel with Teflon sleeves, needs no lubrication, thus reduces maintenance. Minimizes number of valves needed for multiple flow patterns. Comes with 4 or 5 ports, in ½- to 2-in. sizes, flanged or screwed ends. *Continental Mfg. Co.*



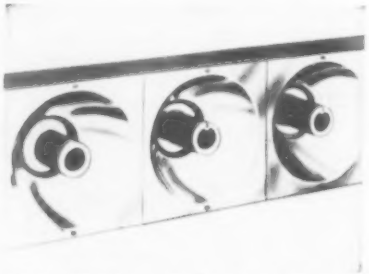
130—Automatic Palletizer stacks four 55- or 30-gal. drums, or nine 120-lb. kegs, one tier high. Adapts to most cylindrically shaped containers. Eliminates man-handling. Works in combination with automatic, electrically controlled drum loader. *Beacon Machinery, Inc.*



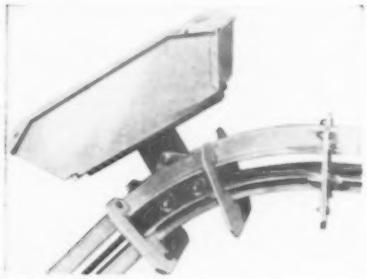
131—Power Torque Driver gives audible signal when it reaches desired torque. Sound is made by balls being forced out of sockets and over-run. For use with any motive power except impact wrenches. Four sizes, torques from 75 in.-lb. to 225 ft.-lb. *Titan Tool Co.*



132—Intake Valve, for use with high-vacuum pneumatic systems, removes or transports dry, free-flowing, powdery, or granular materials from hoppers, bins, and dust collectors. For 2- to 6-in. pipelines. Standard 8-in. flanged connections. *U. S. Hoffman Machinery Corp.*

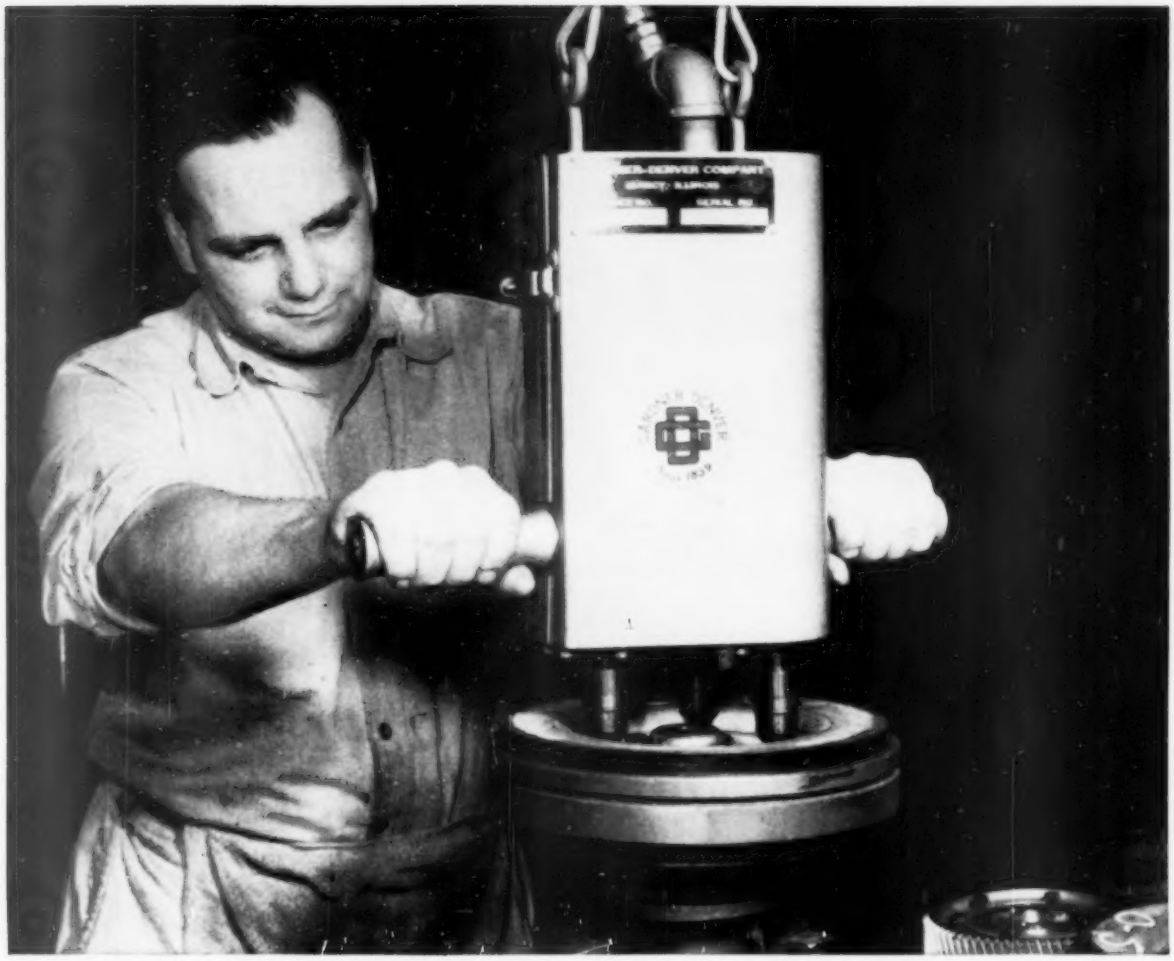


133—Electric Infra-Red Source, lava-sealed, is rated at 1000 watts. Produces temperatures up to 900 F. Makes possible smaller, less costly drying and baking ovens. Unit uses no rods, bulbs, quartz tubes, or sockets; reduces maintenance. *Dry Clime Lamp Corp.*



134—"Chainless" Conveyor moves pans or pallets long distances at varying stops without transfer points. Pan or pallet, with clevis attachment at bottom, bolts to trolley's vertical axles. No pitching or twisting when conveyor starts, stops, curves. *American MonoRail Co.*

Turn the page



In two passes this Gardner-Denver 3-spindle multiple nut setter tightens six bolts on diesel engine flywheel.

Check this special multiple design for fast, accurate nut running

A CONSCIENCE FOR QUALITY

Gardner-Denver equipment at work throughout the world has the conscience of Gardner-Denver men behind it: designers, engineers, metallurgists, instructors, servicemen. To these men there's no substitute for quality, as at Gardner-Denver there's no substitute for men—our 100-year philosophy of growth.

Speed production, control torque with air-powered multiple nut setters—designed to do the job by Gardner-Denver. Motor units, throttle handle, dead handle, manifold—all components are specifically designed for fast, accurate multiple nut running. And all components are standardized units that can be assembled to any combination to run any number of nuts, with each nut tightened to specified torque—*all in a single operation*. Switching from job to job is quick and easy. When the bolt pattern changes, simply move the standard spindles and handles to a new job-tailored mounting plate.

Whatever your production setup—from high-volume assembly lines to low production runs—Gardner-Denver multiple nut setters speed the job . . . cut time and costs. Contact your Gardner-Denver representative for complete information.

GARDNER-DENVER Since 1859 — 1959 — 100 YEARS

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

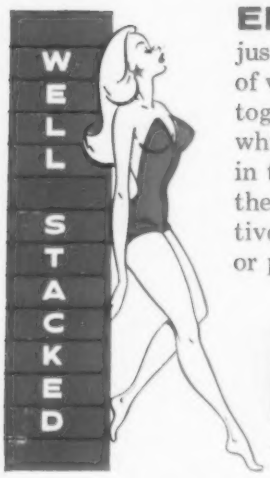
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

For more facts Circle 524 on Reader Service Card

Fast!

EMI air-row head Fully Adjustable Pallet RACKS

- EASY TO ERECT
- ONLY 2 BASIC PARTS
- SIMPLE TO ADJUST
- QUICK TO RELOCATE



EMI AIR-ROW Head Racks easily adjust to stack pallets, skids, dies and bulk of varying heights. Upright frames are tied together with sturdy steel support beams which quickly snap into AIR-ROW slots in the vertical post. Forge lock fittings on the ends of the support beams insure positive self-locking engagement with no sway or pop-out.

WRITE FOR OUR COMPLETE CATALOG!

EQUIPMENT MFG. INC.

21561 HOOVER ROAD ● DETROIT 5, MICHIGAN

For more about these items, circle item numbers on Reader Service Card next to back cover.

135—Pressurized Water Spray combines with detergent to quickly and economically wash away dirt, grease, grime, or scale from equipment, vehicles, walls, etc. For use with 15- to 55-gal. full-open drums. Includes flexible 40-ft. hose, insulated spray nozzle. *Gray Co., Inc.*

136—Machine Safety Lock prevents electrically powered machines or high-voltage systems from starting or running unless safety door or guard is automatically locked in place. Unique fail-safe design is based on mating two halves of split transformer. *Lindly & Co., Inc.*

137—Speed Reducers, shaft-mounted, include a 25:1 double-reduction series in 8 sizes. Output speeds from 12 to 400 rpm. Largest of this line is rated at 154 hp. at 75 rpm. Seven other sizes with torque arms including 3 flange-mounted reducers. *Dodge Mfg. Corp.*

Turn the page

One slip can cost more than USS Multigrip...

What percentage of occupational accidents is caused by falls? In one state, falls were responsible for 17 per cent of all injuries, 33 per cent of the days lost and 23 per cent of the direct cost. (From National Safety News, February, 1959.) Falls ranked No. 1 as the cause of most accidents.

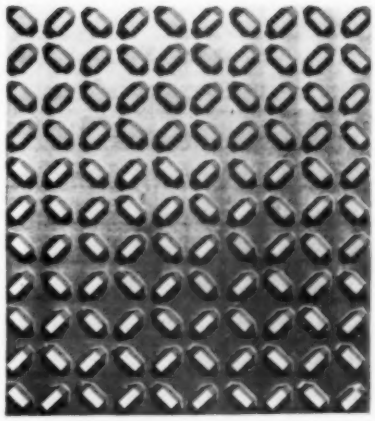
Fortunately, you can do something to prevent falls by installing USS Multigrip. Multigrip floor plate provides safe traction in any direction. It is studded with little cleats that are flat on top and do not catch the shoe.

For dangerous locations such as machine shops, loading platforms, stair treads and catwalks, USS Multigrip supplies safety plus.

Saves money, too! Where floors take a pounding from heavy traffic, Multigrip will stand for years under constant use. There's little or no maintenance.

On your next inspection trip, search out the hazardous locations—and make them safe with USS Multigrip.

USS is a registered trademark



Sold by leading distributors from coast to coast.

United States Steel Corporation—Pittsburgh
Tennessee Coal & Iron—Fairfield, Alabama
Columbia-Geneva Steel—San Francisco
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

Now one wheel for any section of your plant

New Lamilon
NYLON-REINFORCED
ALL-PLASTIC WHEELS
(patent pending)

Now, for the first time, you can standardize on one wheel for all your materials handling equipment in any section of your plant. Regardless of the types of floors or floor conditions, Fairbanks new "LAMILON" Wheels will:

● Protect your floors. "LAMILON" Wheels stay smooth and concentric, will not mar or mark, because of exceptionally high impact strength and abrasion resistance.

● Show no affect from oils and greases and a very high resistance to most chemicals. "LAMILON" Wheels have a water absorption factor almost as low as high quality rubber and will not deteriorate in wet floor conditions.

● Roll easier with alloy steel roller bearings, hardened steel outer race and provision for pressure lubrication. "LAMILON" Wheels roll easier than semi-steel wheels in most instances.

● Last longer and give more dependable service than any other plastic wheel.

"LAMILON" Nylon-Reinforced All-Plastic Wheels are available in sizes 3 through 12 inches and can be furnished with thread-tight thread guards.

Fairbanks complete line of industrial caster and truck wheels includes the finest vulcanized rubber tired wheels (sizes 3"-18") on the market, solid rubber wheels (sizes 2"-6") and semi-steel wheels (sizes 2"-16").

FAIRBANKS "LOCKWELD" CASTERS WITHOUT KING-PIN

Easiest swiveling, longest lasting. Unique patented "LOCKWELD" construction eliminates king-pin, chief source of caster failure.

Illustration: Series "23" double ball race swivel casters, sizes 3"-8". Single ball race swivel casters, sizes 2"-6" and matching rigids available.

THE **Fairbanks** COMPANY

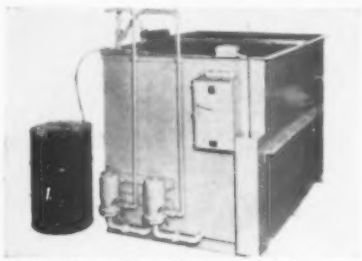
Executive Office — 393 Lafayette Street, New York 3, New York
Valves • Dart Unions • Casters • Trucks • Wheels
● 520 Atlantic Ave., Boston 10, Mass. ● 393 Lafayette Street, New York 3, New York ● 15 Stanwix St., Pittsburgh 22, Pa. ● 202 Division St., Rome, Ga. ● **Factories** — Rome, Georgia and Binghamton, N. Y.

FACTORY / EQUIPMENT NEWS

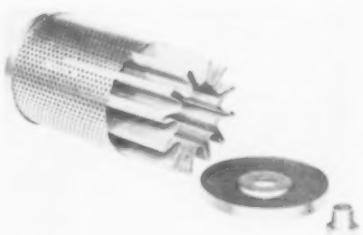
Begins on page 128

For more about these items, circle item numbers on Reader Service Card next to back cover.

138—Pressure Switch prevents fires and explosions by sensing when suction drops to dangerous point in exhaust systems for ovens, steam generators, paint baking, drying, etc. It controls relay which opens circuit to shut off fuel supply. *Gas Appliance Specialties Co.*



139—Cyanide Disposal Unit neutralizes, then eliminates poisonous wastes in plating operations. Neutralization occurs in specially baffled tank with concentrated solution of sodium hypochlorite. Needs no operator. Capacity 800 gph.; 110-v. line. *George L. Nankervis Co.*



140—Liquid Filter, sump-type, for hydraulic and lubricating oil, coolants, etc., provides low-cost removal of dirt, rust, and sludge down to 140 microns. Flow range: 8 to 50 gpm. Easy to clean, no special maintenance. Meets J.I.C. standards. *General Filters, Inc.*

Turn the page

When you buy Motor Starters——

YOU PAY FOR OVERLOAD PROTECTION

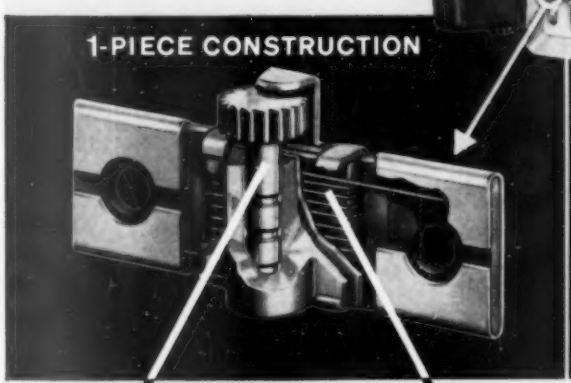
Only ONE-PIECE Overload Relays give 100% Protection • Only with ONE-PIECE construction can you *know* you've installed the heater correctly. Only with ONE-PIECE construction can you *know* the heater is exactly centered, or properly positioned, so that it performs according to its rating. Only with ONE-PIECE construction can you *know* your motors have full protection.

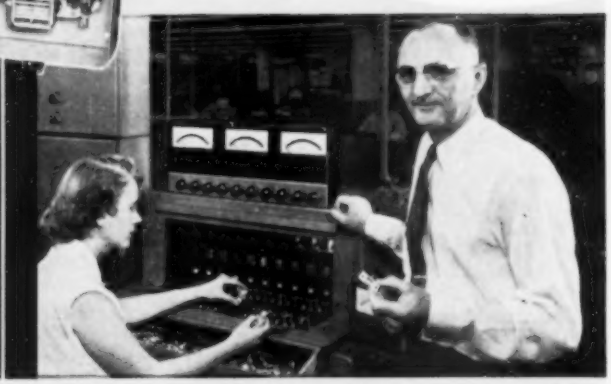
Only Square D has ONE-PIECE Construction • ONE-PIECE construction *eliminates* any possibility of heater misalignment. Square D melting alloy thermal overload relays can be installed only one way. They are tamper-proof. They are factory-assembled, are *individually* calibrated and tested. Repeated tripping will not affect accuracy.

Insist on Square D melting alloy thermal overload relays

Write for Bulletin SM-275 for the complete story on Square D starters with ONE-PIECE thermal overload relays. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

...BE SURE YOU GET IT!





Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.

Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

Individual factory inspection of every Square D melting alloy thermal overload relay means performance you can trust. Each unit is calibrated and thoroughly tested to make sure it will perform according to its rating.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

How to Improve Production Rates and Quality

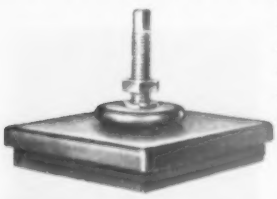
...with

UNISORB

2-in-1 Machine Mounts

- **SMOOTHER OPERATION AT HIGHER SPEEDS**
- **MAXIMUM VIBRATION CONTROL**

Unisorb and Unisorb Level-Rite Mounts are used to control the "vibration personality" of different machine types and loadings, and make them operate more efficiently. See how these features can help you . . .



- Absorbs up to 85% of transmitted vibration
- Allows maximum operating speeds
- Improves quality, cuts rejects
- Maintains precise leveling
- Eliminates bolts and lag screws, no floor damage
- Saves from 30 to 75% — by actual report — in installation time

Lowers noise level, improves worker morale

Protects machines from vibration, preserves building, fewer replacement parts needed.

Try Unisorb on special trial offer! Send us description of one machine you would like to try on Unisorb. We will send correct type and density. If not satisfied, return pads and we will credit invoice. Available from leading Industrial Distributors; or write or call today.

UNISORB 206 SOUTH STREET BOSTON 11, MASS. FE 9-30

Want more information? Send for Unisorb Consolidated Facts Bulletin!

Division of The FELTERS CO.
Please send me a Unisorb Sample and Consolidated Facts Bulletin.

Name.....

Position.....

Company.....

Address.....

City.....Zone....State.....

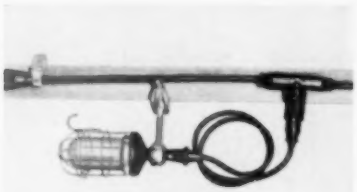
For more about these items, circle item numbers on Reader Service Card next to back cover.

141—Drum Cutter works like giant can opener to eliminate hammer-and-chisel method of removing steel drum heads. Driven by ⅓-hp. motor, it moves around top of drum to cut smooth and lapped edge in less than 2 min. One-man operated; weighs 50 lb. *Krist Machine Works.*

142—Soundproof Louver Door of hollow metal guarantees "privacy of speech" while permitting air to pass through transfer ducts. For offices, conference rooms, etc., where privacy is necessary. Comes with installation parts for 4-in. masonry block wall. *Elof Hansson, Inc.*

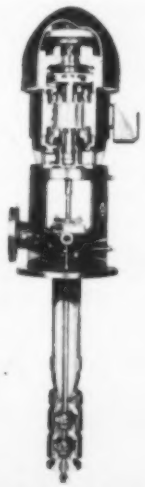
143—"Refrigifilter" lowers compressed air dewpoint to 35 F., condensing over 90% moisture and oil vapors to assure clean air. For use where cooling water is unavailable or where temperatures vary greatly. Rated at 100 scfm. at 100 psig. and 100 F. *Hankison Corp.*

For more about these items, circle item numbers on Reader Service Card next to back cover.



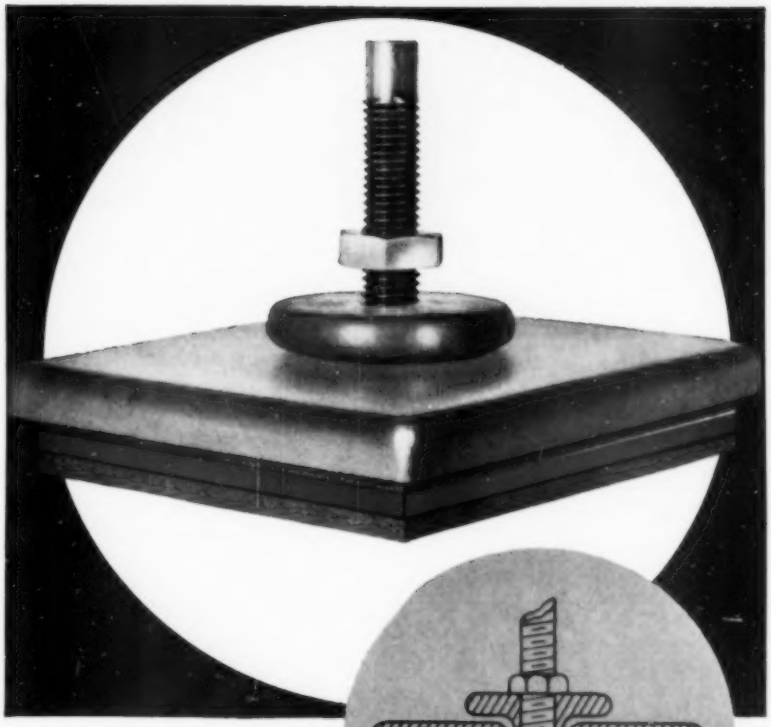
144—Electrical Control Connectors, handling up to 600 v., are water-, dirt-, corrosion-, and crush-proof. Neoprene construction permits severe or repeated flexing without breaking connector-to-cable bond. In oval, round and dual-round styles, 2 to 12 poles. *Joy Mfg. Co.*

145—V-Belt Drive gives choice of 3-belt sizes for compact design: size 3-V (3/8 in. wide) for up to 50 hp.; 5-V (5/8 in.) up to 200 hp.; 8-V (1 in.) up to 1500 hp. Specially designed bushings eliminate wobble to achieve rim speeds up to 6000 fpm. *American Pulley Co.*



146—Vertical Turbine Pump for cooling towers, filter washing, circulating or process pumping, etc., increases capacity wtihout boosting space needs. Seldom needs priming. Low installation cost. In 20- to 8000-gpm. ratings; heads over 400 ft. *Allis-Chalmers Mfg. Co.*

Turn the page



UNISORB

LEVEL-RITE **Machinery Mounting**

The new Level-Rite has been developed as a universal self-contained leveling mount for all types of machinery. It combines the features of Unisorb with the advantages of a rugged, easy-to-use device for precise leveling of machines. Machines are completely "mobilized." One unit required for each machine leg, with load ratings to 7500 lbs. per unit.

Exclusive Screw-Post Design . . . Machine legs mounted on special leveling screw and plate assembly, which rests in all-steel base plate. Machine is quickly and easily leveled by simply rotating the square top of the leveling screw, then securing lock nut. Machines stay level.

No bolts, lag screws or cement . . . Level-Rite eliminates all need for anchor bolts or screws. Designed so compression provides positive hold, no "walking" or creeping under the toughest side loads. Machines can be moved whenever and wherever required.

Superior Unisorb Vibration Dampener . . . Industry's most efficient isolator reduces transmitted vibration up to 85%. Contributes to more productive machine hours, lower building maintenance, higher machine speeds. Unisorb will not deteriorate, is resilient, and is impervious to cutting fluids and cleaning compounds.

UNISORB 206 SOUTH STREET BOSTON 11, MASS.

Want more information? Send for Unisorb Consolidated Facts Bulletin!

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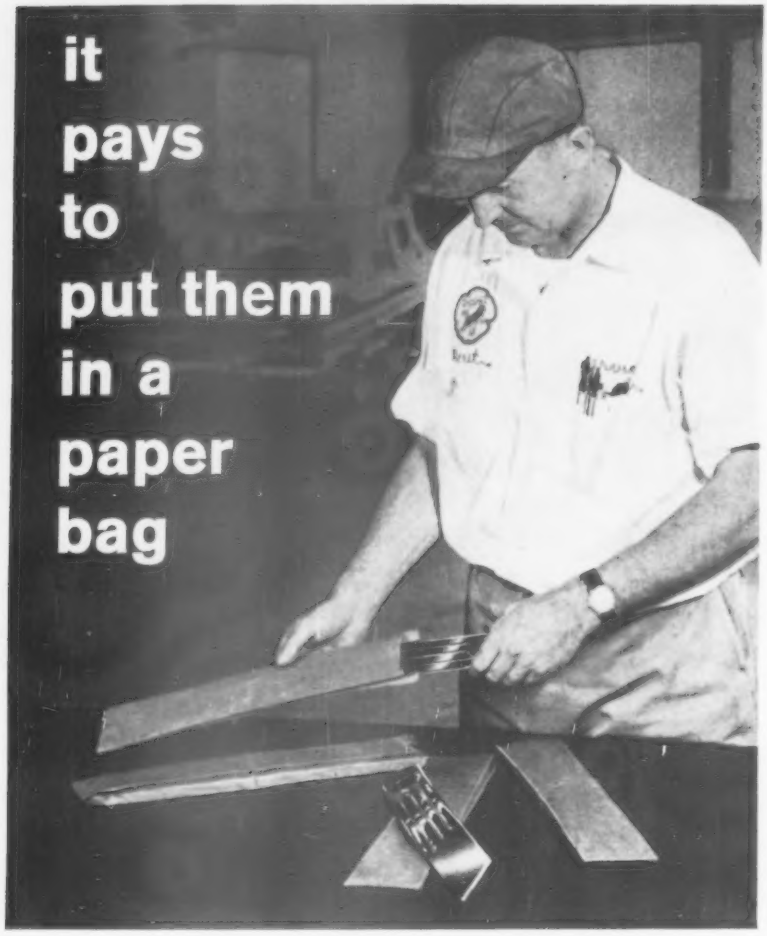
For more facts Circle 529 on Reader Service Card

when you pack and ship PRECISION PARTS



Here's an "economy move" you may have overlooked! By shipping high-finish, precision assemblies in paper bags you lower freight costs. You save packaging time. You reduce damage claims—build customer goodwill.

Each custom-made bag illustrated, packs a reveal moulding used in automobile assembly. Bags are waxed kraft, moisture-proof. They seal out dust—completely safeguard polished surfaces from scratching in transit and storage.

Versatile lightweight paper bags are proving the least expensive, most effective packaging for thousands of different products today. How much could they save you? Write for free booklet CP-1.

union camp

Commercial Packaging

UNION BAG-CAMP PAPER CORPORATION

233 BROADWAY, NEW YORK 7, N. Y.

FACTORY / EQUIPMENT NEWS

Begins on page 128

For more about these items, circle item numbers on Reader Service Card next to back cover.

147—Hydraulic Fork-Lift Truck, 1000-lb. capacity, costs only $299, but compares favorably with other trucks in its class. Battery-powered, it has self-contained charger. For appliances, boxes, barrels, drums, air conditioners, etc. Lifts to 57 in. *Big Joe Mfg. Co.*

148—Silicon Battery Charger restores 6-cell, 12-v. truck batteries to full charge in 8 hours. Two models, for batteries up to 300- and 450-amp.-hr. capacity, cut off automatically when cycle is completed. Plugs into 15-amp., 115-v. outlet. *C & D Batteries, Inc.*

149—Welding Exhauster uses powerful suction from fan system to draw off gases, fumes, smoke, heat. Unit is magnetized to hold fast to piece being welded, or to metal nearby. Simple construction and operation provide low-cost air cleaning. *Car-Mon Products, Inc.*

Turn to page 146

For more facts Circle 530 on Reader Service Card

For more facts Circle 531 on Reader Service Card ➤

CALL THE TRUSCON MAN...

Be sure you're getting your money's worth out of your plant painting program

The most economical way to paint your plant is to be sure that every paintable surface is coated with the type of paint that will stay there *longest*.

There is no one type of paint that is good for all surfaces. It's a real science to formulate coatings for different types of surfaces — and you can take advantage of Truscon's half century of experience at absolutely no cost to you.

Call the Truscon man. He'll survey your entire plant and make a detailed report to you — proving whether your plant is getting all the protection you're paying for. If any surface, inside or out, is not properly protected he will give you a written specification for 100% protection — without obligation.

Truscon coatings have protected plants of all sizes in all parts of the country for 50 years. Names of well-protected Truscon customers will be supplied to you upon request.

See the yellow pages of your telephone directory for the Truscon factory branch nearest you. Or write Truscon Laboratories, Detroit 11, Michigan.

the "cheapest" way to paint is to use the best paint ...it stays on longer

TRUSCON *Laboratories*

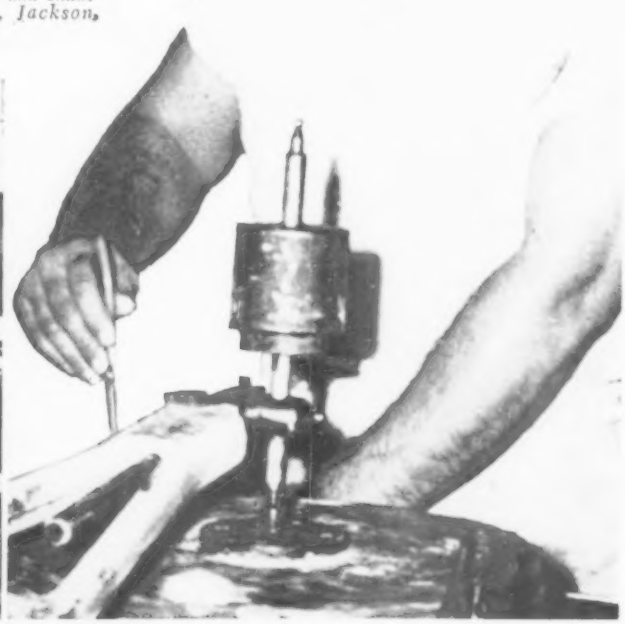
Industrial Maintenance Division of Devoe & Raynolds Co., Inc.
Detroit 11, Michigan

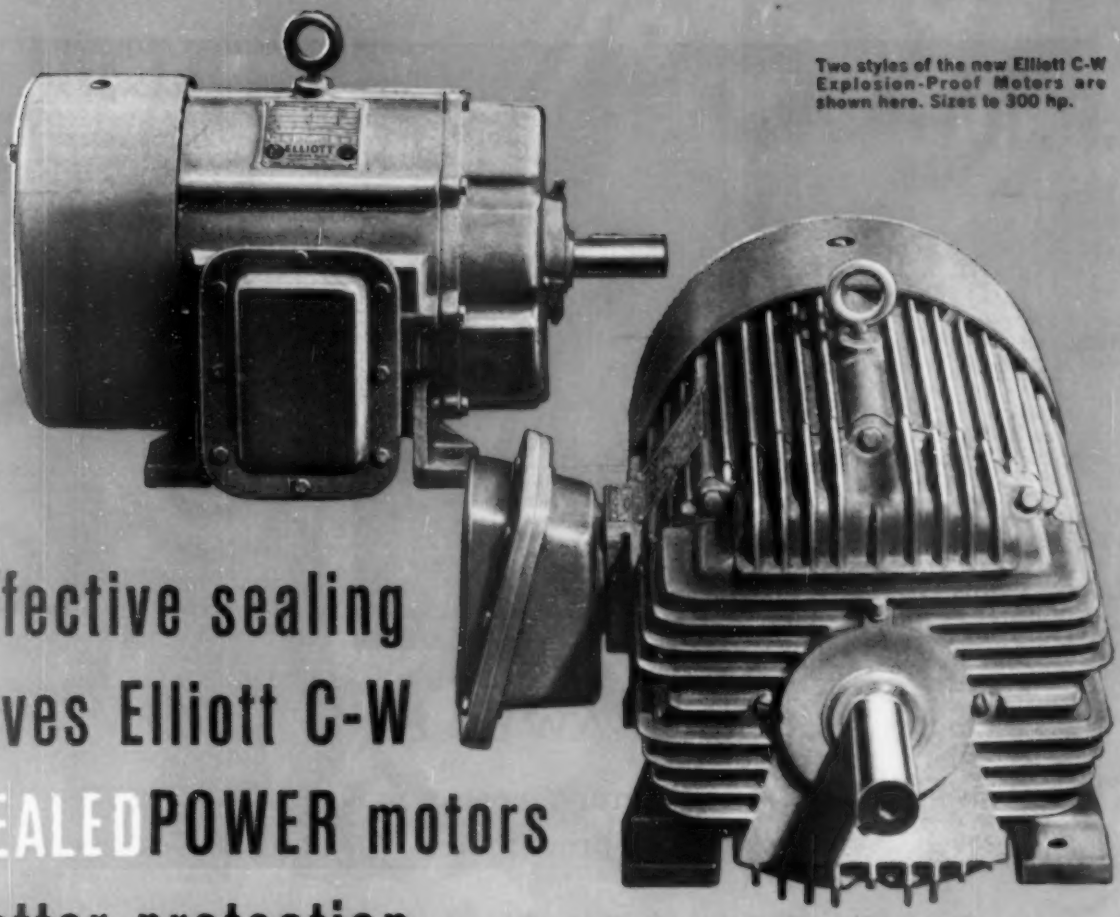
You get a full day's work for a good day's pay

If you've got your sights set on high productivity per man hour, investigate Mississippi. Here workers give their best because they live their best. Mississippi's moderate climate (average temperature 64.5) not only reduces industrial operating costs but also provides opportunities for varied and wholesome recreation all the year 'round. Workers are efficient and adaptable, and their work habits reflect personal pride and integrity. Approximately 100,000 students are enrolled each year in vocational school programs, creating a growing reservoir of skilled, dependable workers. Let Mississippi share with you this high type of manpower which can step up your plant's productivity and profits. For the location of your new plant site there's no better place than Mississippi . . . **where there's room for business and time for living.**

Mississippi

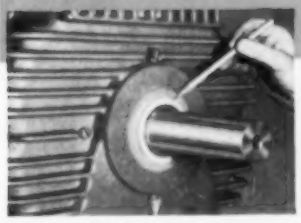
For full information, write to the Mississippi Agricultural and Industrial Board, Jackson, Mississippi.





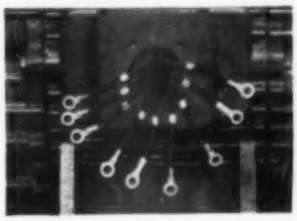
Two styles of the new Elliott C-W Explosion-Proof Motors are shown here. Sizes to 300 hp.

effective sealing gives Elliott C-W SEALEDPOWER motors better protection against moisture, dust, fumes, corrosion



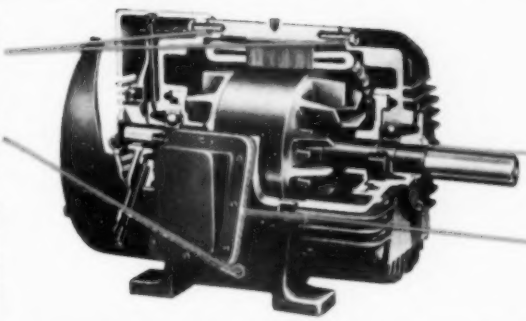
ROTATING SLINGER PREVENTS entrance of dirt and moisture through the bearing and shaft opening.

NO LEAKAGE HERE. Tightly sealed leads and opening. Metal-to-metal fit between conduit box, frame and cover.



LONG, SNUG BRACKET SEAL. Close-fitting, deep rabbet provides explosion-proof type seal for all SEALEDPOWER motors.

EASILY ACCESSIBLE, automatic breather and drain plug, underwriters approved, for removing internal moisture accumulations.



NEW DATA on the complete line of Elliott C-W SEALEDPOWER motors is given in Elliott Bulletin PB 6000-2. Send for free copy today.

Elliott explosion-proof motor—underwriters approved.

ELLIOTT Company

Crocker-Wheeler Plant Jeannette, Pa.

For more facts Circle 533 on Reader Service Card

New low cost paint holds color and gloss!

VALDURA DURAWEAR

Cuts maintenance painting costs yet gives "heavy duty" protection

Money-saving Durawear not only has top color and gloss retention, it gives extra protection to surfaces for many years. Featuring a linseed oil modified alkyd vehicle, Durawear has better brushability than straight alkyd enamels. It is very easy to paint on irregular surfaces since the consistency prevents running off from sharp corners. Use Valdura Durawear on steel, wood or masonry—indoors or out—as illustrated above, on fire escapes, wall surfaces, storage tanks, and wherever protection from elements of weather is desired. Available in five attractive colors.

VALDURA

Please send me complete information and color chips on Valdura Durawear.

VALDURA HEAVY DUTY PAINT DIVISION
AMERICAN-MARIETTA CO.
101 E. Ontario St., Chicago 11, Illinois

NAME_____
COMPANY_____
CITY_____ STATE_____

FACTORY / EQUIPMENT NEWS

Begins on page 128

For more about these items, circle item numbers on Reader Service Card next to back cover.

150—Hydraulic Test Bench checks repaired parts in shop, and troubleshoots operating conditions in field. Tester can be removed from bench and connected to hydraulic system of faulty equipment to spot defects. In components or fully assembled. *Schroeder Bros.*

151—Time Switch offers to-the-minute accuracy for hourly setting from 1 to 24 "on-off" operations per day. Has 24-hr. and 60-min. dials; set-screw marks hours. Optional Skip-A-Day unit gives a minimum of one 2-min. "on" operation per week. *Tork-Time Control, Inc.*

152—Metal Parts Sorter electromagnetically tests ferrous and nonferrous parts for heat-treating conditions, hardness and strength, chemical purity, presence of decarburization. Comes with plug-in meter scales for various metals and conductivity ranges. *Metrol, Inc.*

Turn the page

LONG LIFE WITH NO LUBRICATION...

exclusive T-BLOCK design doubles life of piston rings on JOY oil-free compressors

All Joy oil-free compressors are equipped with carbon-graphite piston rings of T-block design. They require no lubrication and compensate automatically for wear. Blow-by is virtually eliminated for the life of the ring. Brass expanders and stainless steel springs operating in teflon sleeves provide the piston rings with controlled pressure evenly distributed on the cylinder walls. Result: "bug-free" operation and freedom from corrosion. Compressor owners report ring life of 8000 operating hours, and more.

If your operations require oil-free compressed air, whether for instrumentation or for processing, get complete details from Joy. A complete line of oil-free compressors is available from 95 to 3600 cfm, 15 to 600 hp.

Ask for free bulletin 301-12.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

I 7519-301

For more facts Circle 535 on Reader Service Card

FREE TRIAL OFFER

Discover what customized MASTER POWER AIR TOOLS can do to increase production

Test Master Power Air Tools without obligation. They are fitted individually to your job, precision-built and can frequently be serviced on the spot. Men who use Master Power tools like their speed and heft.

Discover how Master Power can step up production and reduce down-time. Performance on specific applications in your plant is proof of their power, versatility and quality. Mail the coupon today for a 10-day tool test . . . at no cost and without any obligation.

Master Power

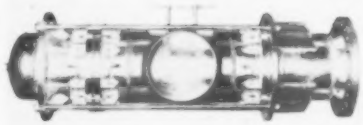
CORPORATION • Bedford, Ohio

A Black & Decker subsidiary

Look under TOOLS-PNEUMATIC HOISTS-PNEUMATIC

For more facts Circle 536 on Reader Service Card

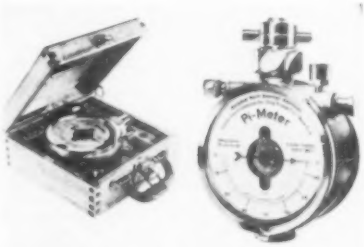
For more about these items, circle item numbers on Reader Service Card next to back cover.



153—Expansion Joint, for elbows or joints where piping changes direction, uses counterbalancing outer bellows to absorb line pressure where anchoring is impractical. Eliminates pressure thrust. In 3-in. to 50-ft. dia., −320 to +1600 deg., to 2500 psi. *Zallea Bros.*

154—Shock-Absorbing Riveter has rubber-bonded nozzle to reduce high-frequency vibration transmitted from tool to operator. Also cuts noise. For light riveting, chipping, scaling, calking, nail-driving. Four sizes handle ⅛- to ¼-in.-dia. cold rivets. *Ingersoll-Rand Co.*

155—Safety Switch has highly visible red insulated front-operating handle and large metal nameplate for on-off identification from 100 ft. or more. Ratings for heavy-duty are 250- and 600-v. a-c. 30 to 600 amp.; light-duty, 120/240-v. a-c., 30 to 600 amp. *General Electric Co.*



156—Engine Performance Meter, for diesel, gas, steam, and gasoline engines, spots imbalance in cylinder loads and measures power output. Permits rapid adjustment. Useful to determine power output of high-speed engines in field. Requires no technical training or special skills to operate. *Korfund Co.*

For more about these items, circle item numbers on Reader Service Card next to back cover.

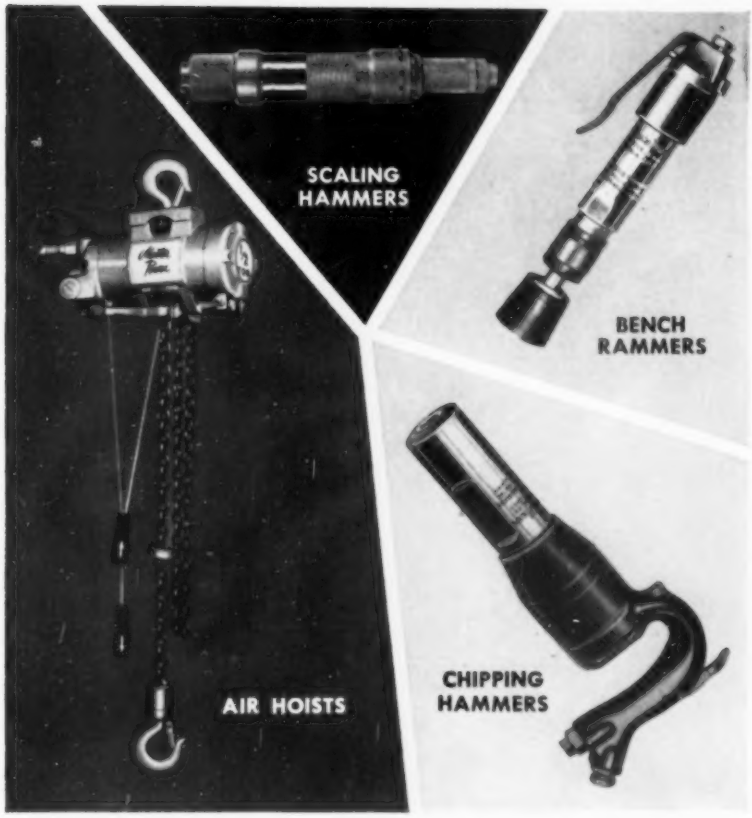
157—Portable Battery Charger provides automatic low-cost d-c power for hand and rider-type lift-truck batteries. Temperature-compensated relay cuts in time clock for final 3-hr. charge when battery is ¾ charged. Generator capacity, 3-15 kw. *Motor Generator Corp.*

158—Atomizing Spray Nozzle, of hard rubber, is good for corrosive liquid-spraying applications. It produces a hollow cone spray pattern. Atomization is accomplished through hydraulic pressure. Capacity from 1 to 26 gph. at 40 psi. Acid-resistant. *Spraying Systems Co.*

159—Vacuum Cleaner, with 1½-hp., 3-stage, self-cooling motor, handles difficult dry-cleaning jobs without clogging or reduction of suction power. Converts to power blower or liquid recovery unit in two seconds. Capacity, 12 gal. *Pullman Vacuum Cleaner Corp.*

Turn the page

10-DAY TOOL TEST



Discover how customized MASTER POWER AIR TOOLS are custom-sold, custom-installed and custom-serviced

Sold and serviced in 49 principal cities in the United States and Canada.

MAIL COUPON TODAY FOR 10-DAY FREE TRIAL

Master Power **Corporation, Dept. 309, Bedford, Ohio**

Gentlemen: I want to run a Master Power 10-Day Tool Test. I understand that there is no obligation.

- ☐ I am interested in *Impact Wrenches*
- ☐ I am interested in *Threaded Fastening Tools*
- ☐ I am interested in *Percussion Tools*
- ☐ I am interested in *Abrasive Tools*
- ☐ I am interested in *Air Hoists*

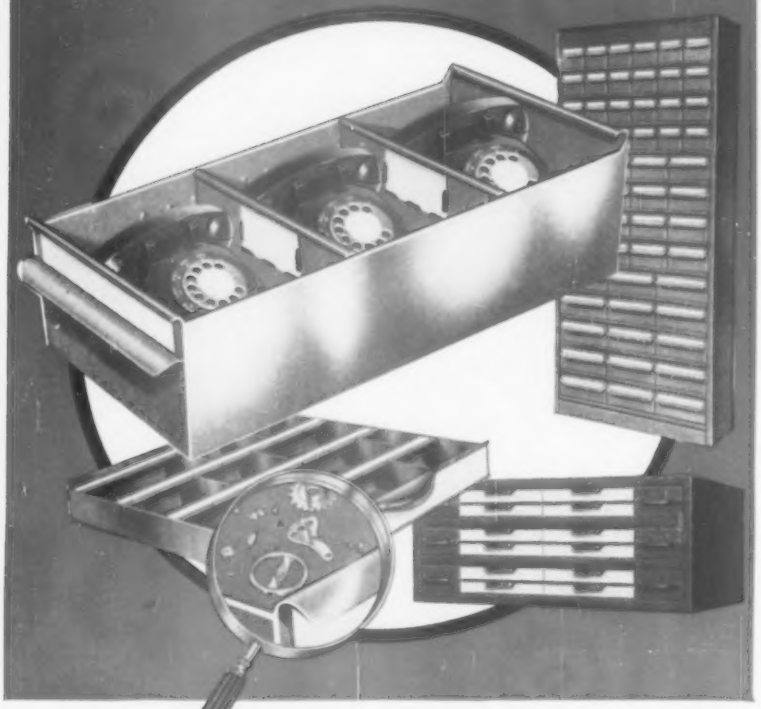
Company.....

Individual.....

Street..... City..... Zone..... State.....

In Canada: MASTER POWER TOOLS (CANADA) LTD., REXDALE-TORONTO, ONTARIO

If your parts are large or small —
Equipto drawers will take them all



Equipto Drawers
now in all sizes

The vast and varied Equipto line offers the widest selection of capacities and combinations ever built into drawer storage units. They include everything from simple 2 drawer units to the large 7' high multi-drawer combination shown above. They are of heavy duty construction and not to be confused with other units on the market. Different types of interchangeable drawers permit thousands of arrangements within the units to satisfy your needs – up to 6,184 drawer compartments in only 3 sq. ft. of floor space.

Some of the drawers are shallow for tiny parts . . . others are Jumbo size for large objects. Up to (17" long by 11¼" wide by 6⅛" deep) All have adjustable dividers that lock in place – can't creep up – small parts cannot get from one compartment to another. Heavy gauge steel construction protects parts . . . prevents s ging or sticking . . . prolongs life of units.

Equipto is the most complete line of drawer and drawer units on the market. Send for your free copy of big 32 page drawer catalog No. 302 showing hundreds of different units. Don't delay, act today!

SHELVING BENCHES DRAWER UNITS LOCKERS EQUIPTO ROBE STOCK CARTS EQUIPTO ANGLE

Equipto

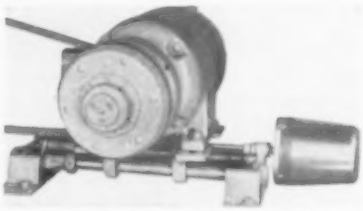
812 Prairie Avenue
Aurora, Illinois

FACTORY / EQUIPMENT NEWS

Begins on page 128

For more about these items, circle item numbers on Reader Service Card next to back cover.

160—Mobile Ramp, for yards and warehouses, rolls into position on 16-in. hydraulically adjusted rubber tires. Over-all lengths from 25 to 36 ft. so inclines won't exceed 10 deg. Checkered steel 70-in.-wide deck plate for all-weather traction. *Elizabeth Iron Works, Inc.*



161—Remote Speed Control governs position of sliding motor base on variable pitch sheave drives. Rating ¾ hp., with potentiometer-type actuators in single and three-phase, also 500-watt two-phase servo types. Delivers 200 in.-lb. at 50 rpm. Low cost. *Jordan Co.*

162—Conveyor Pulley, in 6- to 60-in. dia., 12- to 66-in. face widths, has cold-formed crown to increase metal strength 25%. It's concentric to 0.030 in., and free from crown welds. True center crown helps to set belt, keep it centered for longer life. *Link-Belt Co.*

Turn the page

THERE MUST BE AN EASIER WAY

DRAFTING ROOM'S DARKEST HOUR— ANOTHER SET OF DRAWINGS TO BE "ONLY SLIGHTLY MODIFIED"
ALL OF THESE WILL HAVE TO BE RETRACED TO GET THE CONNECTING RODS LARGER
IF WE CAN'T HIRE EXTRA DRAFTSMEN THIS WILL TIE US UP FOR WEEKS
I FORGOT WHAT IT'S LIKE TO WORK ON NEW DESIGNS, ALL I DO IS RETRACE OLD DRAWINGS
I FEEL LIKE A GREAT BIG RUBBER STAMP
MAYBE YOU CAN GET SOME GUYS FROM BARNUM AND BAILEY WHO CAN DRAW WITH THEIR HANDS AND TOES
THIS DOES IT! I'M TAKING A JOB WHERE THEY HAVE A BLUEPRINTER MAKE AUTOPOSITIVE PAPER INTERMEDIATES INSTEAD OF RETRACING

Much easier for you —and much more economical, too—when you give even the smallest "retracing" jobs to your print room or local blueprinter.

Just indicate the unwanted detail . . . and request that it be "dropped out" when the drawing is reproduced on Kodagraph Autopositive Paper Translucent. Then all you have to do is add the new design on the Autopositive and a new drawing is ready—in a fraction of the retracing time, *at a fraction of the cost!*

Kodagraph
Reproduction Materials

New free booklet lists 7 drafting short cuts, and ways you'll improve print quality with Kodagraph Reproduction Materials. Send for it today.

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Graphic Reproduction Division, Rochester 4, N. Y.

MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY
Graphic Reproduction Division, Rochester 4, N. Y.

Gentlemen: Send me a free copy of your booklet on Kodagraph Reproduction Materials. 17-9

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Company_____

Street_____

City_____ Zone_____

State_____

Kodak
TRADEMARK

It's a fact...

HEAVY-DUTY ENGINES IN ALLIS-CHALMERS LIFT TRUCKS

SAVE YOU MORE
MAKE YOU MORE

The heavy-duty industrial engines in Allis-Chalmers lift trucks stand alone in their ability to take tough work for long periods. The fact that they are the most rugged used in lift trucks means thousands of extra work hours, minimum maintenance, more years of service.

The fact that they deliver more usable horsepower means they do extra work every hour — maneuver faster, climb steeper grades. An Allis-Chalmers 2,000-lb truck, for instance, climbs a 40-percent grade loaded — other makes in the same class climb grades of only 18 to 28 percent.

Does the engine make a difference? Just listen to these users.

"They're brutes for punishment," comments a spokesman for a Michigan firm. "We formerly replaced an engine a year — haven't replaced any in the Allis-Chalmers trucks in over three years of operation."

No major engine overhaul under 10,500 operating hours for the 19 Allis-Chalmers trucks at a New York establishment. "We actually overhauled the first engine as an experiment — we wanted to know what made it tick for 10,500 working hours."

"They use less fuel than other trucks do," says a chief mechanic in Wisconsin. "Allis-Chalmers lift trucks also are tougher than others and require less maintenance."

Put an Allis-Chalmers lift truck to work and you will see many advantages of its heavy-duty engine *immediately*. But it will take years to reveal *all* the benefits. Let your dealer give you more facts — and a demonstration. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

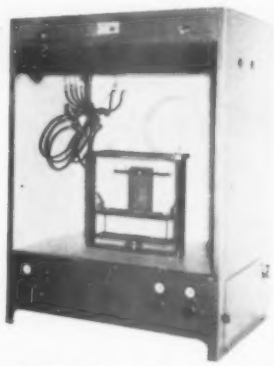
BH-120

For more facts Circle 539 on Reader Service Card

For more about these items, circle item numbers on Reader Service Card next to back cover.

163—Motor Control Center is lightweight, compact, with low installation cost. Absolutely safe—impossible to touch live conductors. Plug-in components match and are interchangeable. Loads from 30 to 600 amp., 120 to 600 v. *Electric Distribution Products, Inc.*

164—Diesel Engine-Generator provides smooth-running, full-rated 25 kw. for primary and emergency standby applications. Features faster voltage recovery, less voltage fluctuation than standard units, no moving parts in exciter and regulator. *D. W. Onan & Sons, Inc.*



165—Paint Sprayer automatically covers 1, 2, or 3 oval or rectangular surfaces of varying height. Produces fine mask definition and paint demarcation. Overhead traveling guns tilt in one or two directions. Uses existing air pressure system. *Conforming Matrix Corp.*

Turn the page

NO TROUBLE CALLS WITH PUSHMATIC . . .

bolted connections are standard on every breaker

Ever hear of "nuisance tripping" in circuit breakers? It occurs regularly in many plants — boosting maintenance, hampering production, costing plenty. But not when Pushmatic® is on the scene. Here is a circuit breaker that thinks for itself — that puts an end to trouble calls. And here's why...

Unlike plug-in type breakers, a Pushmatic *bolts* to a bus bar, cannot work loose and cause excessive heating. It provides a high-pressure, low-resistant, *positive* connection always.

No complicated installation either. It can be installed simply and quickly by merely tightening a captive screw onto the bus bar.

Other Pushmatic plusses: Pushbutton convenience and control . . . quality you can depend on. More than a dozen individual tests are given each and every Pushmatic before packaging. The result is *proved* performance *every* time. Get Pushmatic and end trouble calls.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

® In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

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when your fastening job calls for
INTERNAL WRENCHING

Apex special driver for hex head fastener, with open end to accommodate circular inner flange.

APEX

Apex special driver for internal wrenching nut with threaded hole.

INTERNAL WRENCHING TOOLS
STANDARD · MAGNETIC · SPECIAL

Apex driver for socket screws. For #5 to 3" cap screws; #10 to 2" set screws. ⅜" to 1" female square drive adapters.

Apex one-piece power bit, to drive socket head screws. ¼" to ⅝" hex shanks. For #5 to 1" cap screws; #10 to 1" set screws.

Apex male square inserts, for pipe plugs. ¼" to 1" male square. ¼" to 1" female square drive adapters.

Apex magnetic bit holder and insert bit, to drive socket head screws. Full range of standard and magnetic holders. Inserts for 1/16" to ½" cap screws; #5 to ¾" set screws.

Write, on your company letterhead please, for

CATALOG 30-A—Standard & Magnetic Nut Running Tools, ¼" to ⅝" sq. dr.

CATALOG 30-B—Standard & Magnetic Nut Running Tools, ¾" to 3½" sq. dr.

CATALOG 30-C—Standard & Magnetic Screwdriving Tools

CATALOG 30-D—Miscellaneous Fastening Tools

APEX FASTENING TOOLS
SCREWDRIVING · NUT RUNNING · SPECIAL
The APEX Machine & Tool Co. • 1035 So. Patterson Blvd. • Dayton 2, Ohio

FACTORY / EQUIPMENT NEWS

Begins on page 128

For more about these items, circle item numbers on Reader Service Card next to back cover.

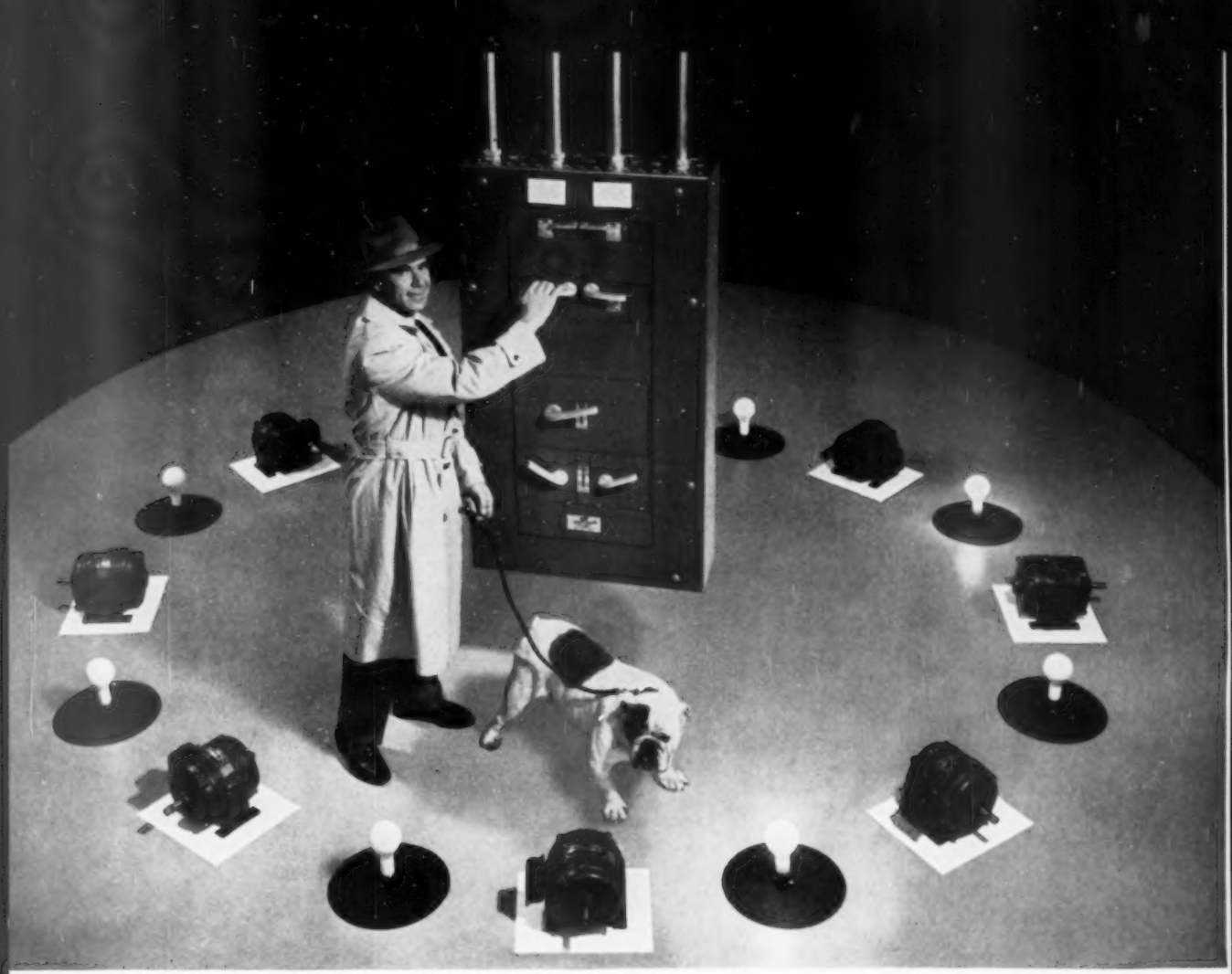
166—Telescoping Conveyor, in three 18-in.-wide sections, pivots and swings around columns, stacked cases, etc. Extends from nearly 12 ft. to 29½ ft. in minutes. At discharge end, feeds any point from straight to about 90 deg. left or right. *Alvey-Ferguson Co.*

167—Panel Instruments, 4⅝ in. wide with a 4-in.-long scale, are virtually unaffected by stray magnetic fields. This full line of rectangular-shaped units includes milliammeters, microammeters, and voltmeters. Accuracy of d-c units, ±2%; of a-c, ±3%. *Daystrom, Inc.*

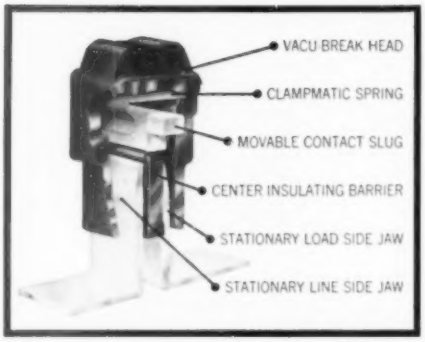
168—"Brakemotor" has doughnut-type magnet in brake to allow shaft to extend entirely through. Motor has both magnetic brake and cooling fan—totally enclosed and sealed. Main parts of aluminum alloy. Ratings to 30 hp., frame sizes from 182 to 326U. *Reuland Electric Co.*

169—Temperature Detector responds to thermal conditions over entire cord length. Bends to shape for difficult locations, irregular-shaped equipment. Standard elements (2 to 10 ft.) connect in series to detect heat from 255 to 1200 F. *Fenwal Inc.*

Turn the page



Compact central power control—*with Vacu-Break protection*



VACU-BREAK CONTROL snuffs arcs immediately when breaking circuits under load. The enclosed head limits the oxygen available during the brief arcing period. Closeness of the head material causes the arc to cool and extinguish quickly. "Double-break" action reduces the distance the Vacu-Break head must travel before the arc is extinguished. In addition, Clampmatic action assures bolt-tight contacts, accelerates breaks.

BullDog Vacu-Break® Power Panels provide the efficient, economical way to centralize lighting and power distribution. One compact panel controls a host of lights and motors . . . saves space . . . provides real circuit flexibility.

BullDog Power Panels are prefabricated . . . switch units are quick-make, quick-break, standardized and interchangeable. Units are available from 30 to 600 amperes. It is simplicity itself to convert the panels when circuit requirements change.

Exclusive Vacu-Break control snuffs arcs quickly . . . Clampmatic® action assures bolt-tight switching connections—longer equipment life. For safety's sake—and superior performance—specify BullDog Vacu-Break Power Panels.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

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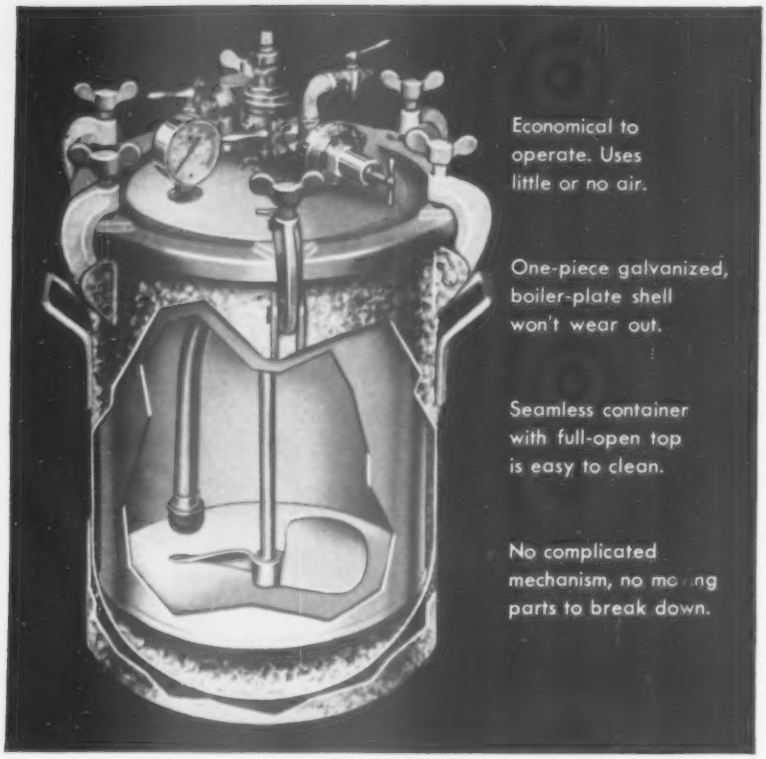
Economical to operate. Uses little or no air.
One-piece galvanized, boiler-plate shell won't wear out.
Seamless container with full-open top is easy to clean.
No complicated mechanism, no moving parts to break down.

The most efficient, most trouble-free fluid supply system ever devised!

Compare for yourself! For supplying paint adhesives, lubricants and similar liquids to spray guns, nozzles, remote outlets, no other method can match these important benefits of the DeVilbiss pressure-feed system:

1 **DEPENDABILITY!** Delivery is always consistent, and not dependent on proper functioning of pumps and other mechanical devices.

2 **EFFICIENCY!** Direct-applied pressure eliminates pump or booster mechanisms that take extra power to operate.

3 **FOOLPROOF OPERATION!** No moving parts to wear, bind, or get out of order.

4 **UNIFORM FLOW!** The steady force of static pressure assures absolutely uniform flow rate.

5 **LOW COST!** Initial purchase price is less. Maintenance is negligible.

If you want the simplest, most practical means of delivering material under constant pressure (up to 110 psi), see your distributor for a DeVilbiss Pressure-Feed Tank. Sizes: 2, 5, 10, 15, 30, and 60 gallons.

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Toledo 1, Ohio
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FOR BETTER SERVICE, BUY
DEVILBISS

FACTORY / EQUIPMENT NEWS

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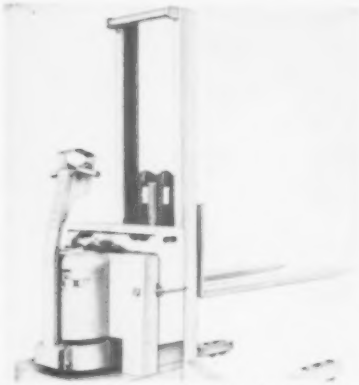

170—Straddle Lift Truck handles pallet loads in narrow aisles where rider trucks are not required. Drive wheel and transmission pivot, motor remains stationary. Power leads to motor never loosen, thus maintenance greatly reduced. Capacity 4000 lb. *Barrett-Cravens Co.*

171—Torque Controller makes accurate force measurements automatically, shutting off power at optimum point. Prevents damage to expensive tools or bits in working with hard alloys. Tightens correctly in "run-up" of precision nut-and-bolt assembly. *TippTronic, Inc.*

172—Dry Vacuum does complete job on rugs, hard floors, walls, and overhead trim in one trip. "Speed-Clean" has disposable filter bag, reusable refuse collection bags. Dust-mop well sucks dirt from mops, cloths, erasers, without spreading. *Nobles Engineering & Mfg. Co.*

IT'S EASY TO MAKE A CONNECTION WITH UNIVERSAL LIGHTING DUCT!

BullDog Universal Lighting Duct is extremely easy to *assemble* and *install*. This versatile system offers you 5 methods of suspension to meet installation requirements. The duct is standardized and prefabricated. What's more the entire lighting system can be relocated on the "ULD" without costly rewiring when lighting needs change.

"ULD" is a continuous electrical outlet system, available in 20-amp and 50-amp ratings. Conductors run the entire length of the duct. Two types of twist-out plugs are available to tap power: the *terminal twist-out plug* for direct wiring to lighting fixtures, and the *receptacle twist-out plugs*, which will accept a standard attachment cap. Wherever plant equipment is located, "ULD" plugs twist in to provide power for maximum illumination without causing costly production shutdowns.

You'll find Universal Lighting Duct is less costly than installed pipe and wire. The duct both feeds and supports lighting fixtures . . . is completely reusable when lighting requirements change. And it's U/L listed.

Whether you're modernizing or planning new construction, you'll find BullDog Universal Lighting Duct is the most efficient, economical and flexible lighting duct system available.

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For more facts Circle 544 on Reader Service Card

Lubrication

NEW GREASE WITH EP PROPERTIES TAKES 700°F TEMPERATURES

In three years of field testing, a unique new grease called Thermatex EP 1 has:

—lubricated plain bearings operating at 700°F.

—regularly withstood steam pressures of 125 psi at 300-325°F for 20 hour periods.

—effectively lubricated equipment handling corrosive chemicals.

—resisted coking and solidifying in steam joints where temperatures reach 400°F.

Advantage lies in unique combination of properties

Users agree that the major benefit of Thermatex lies in its unique combination of extreme pressure properties with high heat resistance. While several greases now on the market have one property or the other, Thermatex is believed to be the first which effectively combines both.

Maintenance savings stressed

The use of Thermatex has already helped slash maintenance costs in a surprisingly wide number of applications. To indicate its potentialities —here's what happened when it was used in the steam joints of a paper drier machine: The previous grease used by a West Coast paper manufacturer would invariably solidify and coke in the last few feet of its supply line under the 400° heat. These failures occurred as often as every two weeks.

Three years ago, Texaco persuaded the manufacturer to give the experimental grease a trial. Since then, according to the user, no lubrication failures whatever have occurred, and no evidence of coking or plugging has been recorded.

Capabilities and limits

Information now available shows that Thermatex EP 1 will lubricate satisfactorily at 450-500°F when relubrication occurs every 3 or 4 days. It will provide adequate protection at 550°F with more frequent lubrication periods. Over this figure, the grease's useful lubricant life is measured in hours, but a centralized pressure system can still insure completely adequate lubrication.

For complete information and test results, check the coupon.

Oil mist lubrication gaining wide acceptance

Lubrication by means of an oil mist or fog is rapidly proving its advantages in many types of industrial machines. According to plant engineers, use of oil mist can provide a relatively inexpensive, truly centralized lubrication system.

How it works

In this type of system the oil is atomized into extremely fine particles—less than 2 microns in diameter. The resulting fog can be carried long distances through straight pipes and around bends without any appreciable condensation. The oil condenses only on fast moving parts —where it is needed. On slower moving parts reclassification fittings are used to produce either spray or droplets.

Advantages are significant

Proponents of oil mist lubrication cite a number of advantages the system has over conventional lubricating methods. They include the following:

Use of oil mist eliminates the danger of drippage which might contaminate the material being processed. Points which are hard-to-get-at or in dangerous locations can be lubricated from one convenient spot.

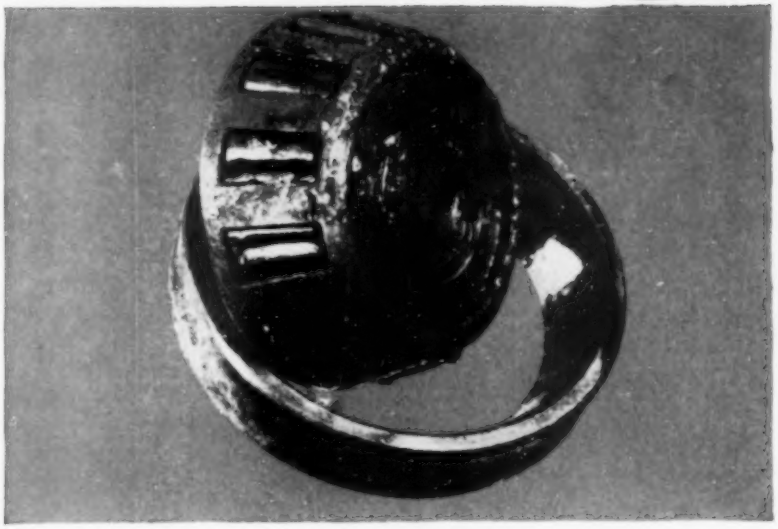
Positive air pressure in the system tends to check the entrance of contaminants such as water, dirt and abrasives—while the air itself provides some cooling effect.

Choice of oil is important

Experts offer a word of caution when it comes to selection of the oil. To be avoided are oils containing graphite, latex, insoluble soaps, fillers or other solids. Best choice seems to be an oil with viscosity at 100°F. (SU) of not over 1,000 seconds.

Texaco products tested and recommended for oil mist applications include Regal Oil PC R&O, Regal Oil C R&O and Meropa Lubricant 1. Test results for these and other recommended Texaco oils are available. Check coupon at right.

news



The difference between Fe_2O_3 and $Fe_2O_3H_2O$ exonerated the lubricant in this bearing failure.

Deposit analysis can uncover surprising reasons for failure

When equipment fails, industry's natural tendency is to blame the lubricant. For this reason, samples of oils and greases—often no more than mere specks—sections of failed gears, bearings, and other ruined pieces of equipment are analyzed at the Texaco Research Center, Beacon, N. Y. Here they are subjected to a searching analysis by technical service experts using a tremendous variety of apparatus and procedures.

Lubricant is seldom guilty

Of the numerous samples submitted every year, the lubricant is guilty in less than 1% of the cases. Take a typical example:

A customer submitted the roller bearing illustrated above. The bearing and its lubricant were liberally contaminated with both red and black material. X-ray diffraction analysis disclosed that the contaminant was an alpha ferric oxide which is characteristic of fretting corrosion—usually correctable only by a design change. Had ordinary rusting occurred the contaminant would have been hydrated ferric oxide—and a finger could have been pointed at the lubricant for allowing water to come in contact with the bearing.

The March, 1958, issue of Lubrication Magazine contains a fascinating series of these "detective" stories. Write for your copy; the supply is limited.

Explains Significance of Lube Tests

The October issue of Lubrication Magazine is designed to give the lubricant user new insight into the significance of lubricant tests. The article demonstrates how the tests—which determine some lubricant properties—can help the lubrication engineer in selection of lubricants for specific equipment. Check the coupon for your free copy.

NEW PRODUCT NEWS

Chemical grinding coolant leaves no oily film—keeps machines cleaner. Helps prevent heat check, permits the use of a finer grit wheel—*Cooltex.*

Selection of cutting or grinding fluids can be critical production problem

Which is best—a straight cutting oil, a soluble oil emulsion, or a chemical coolant? Picking the right type is often a difficult problem, yet the correct choice can often yield major production savings, according to Texaco's chief Metalworking Engineer.

Multitude of factors complicate job

It is pointed out that there is no "best" type of fluid—it all depends on the type of operation. Some cutting jobs, for example, can get by with just a coolant, others—such as automatic screw machines—need a fluid that can lubricate as well as cool, because of inevitable leakage between sumps. Physical properties of the work, high heat—even hard water—can also affect the choice.

Grinding: New chemical coolant adds to choice

Chemical coolants—like Texaco's Cooltex, for example, are comparative newcomers to the grinding operation. However, many operators can point to production boosts of over 200% by using Cooltex instead of an oil. But again it all depends on the particular problems of the operation.

Expert advice can save money

Also underlined is the fact that calling in an expert to discuss cutting oil requirements can pay off for a great many manufacturers. Texaco, for example, maintains a staff of Metalworking Lubricant Engineers from coast to coast, whose prime function is consultation on cutting oil problems.

TEXACO INC., 135 East 42nd Street, New York 17, N. Y., Dept. F-LN-30

Dear Sirs:
Please send me more information on

- ☐ Thermatex
- ☐ Cooltex
- ☐ Recommendations for oil mist lubricants
- ☐ Please send the October issue of Lubrication Magazine

Name_____

Firm_____

Address_____

City_____

Zone_____ State_____

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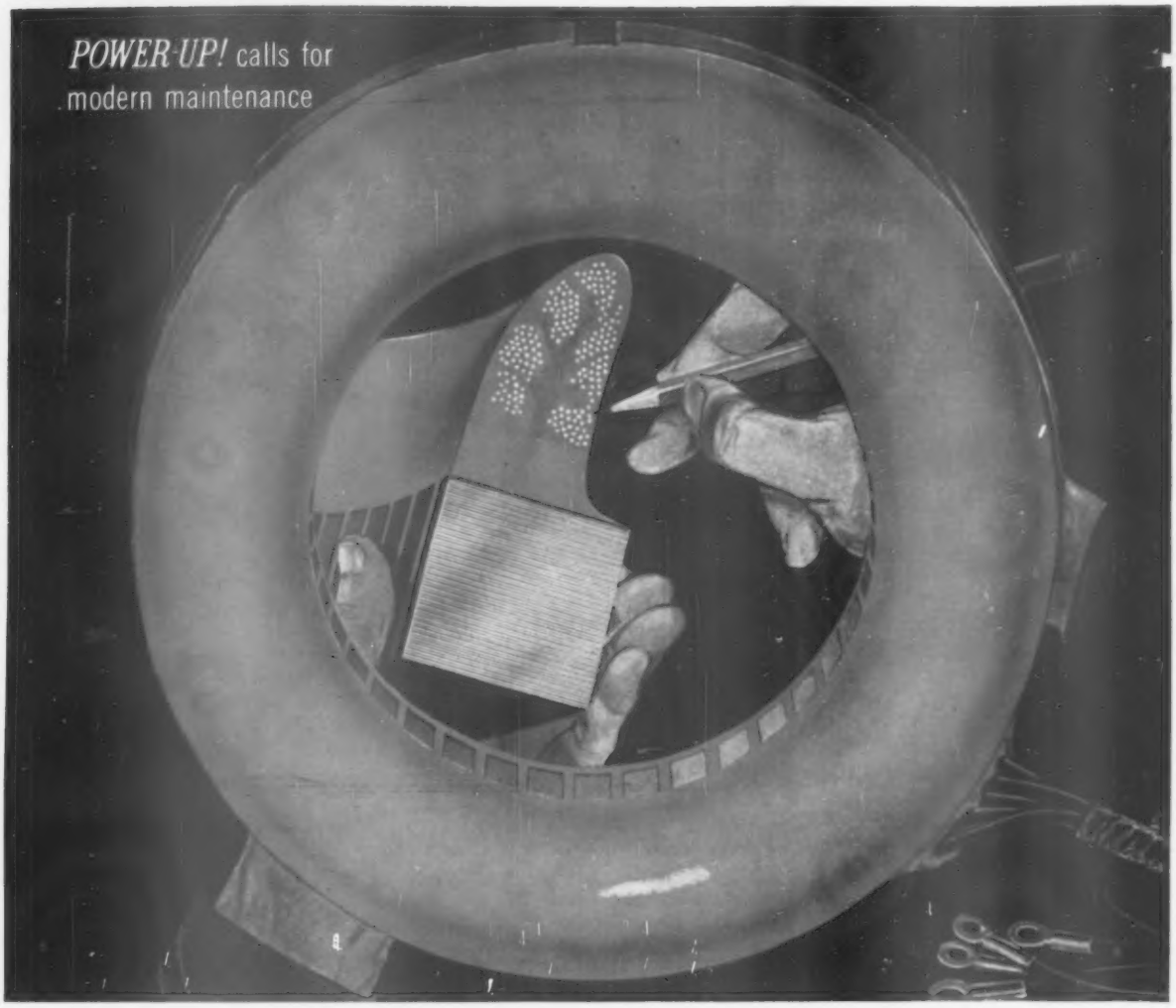


New Super Coilife gives rewound motors extra life

Moisture, acids, alkalis and other contaminants are locked out once and for all with Super Coilife epoxy encapsulation. For full motor protection, Super Coilife can be applied to random wound stators, rotors and armatures. Super Coilife's mirror-like finish will not crack or craze under severe operating conditions.

Because of its unusually low viscosity, this new solventless epoxy completely penetrates the interstices, through the slots, thoroughly coating and protecting the windings. Since 1953, when Westinghouse introduced Coilife* epoxy encapsulation, research, engineering and development have evolved this new and improved product—Super Coilife, an exclusive process.

Only Westinghouse Repair Plants can give the right "thin-wall" thickness for each type and class of winding to give maximum heat transfer away from the windings. Before you send out your next rewind call your Westinghouse representative for the complete story or write for Booklet B-7622: Westinghouse Electric Corporation, P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa.

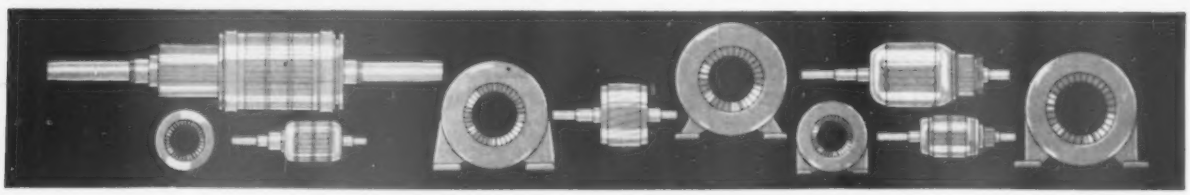
*Trade-Mark J-95197-A

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

USE WESTINGHOUSE MODERN MAINTENANCE SERVICE... SHOP REPAIRS... RENEWAL PARTS... FIELD SERVICE

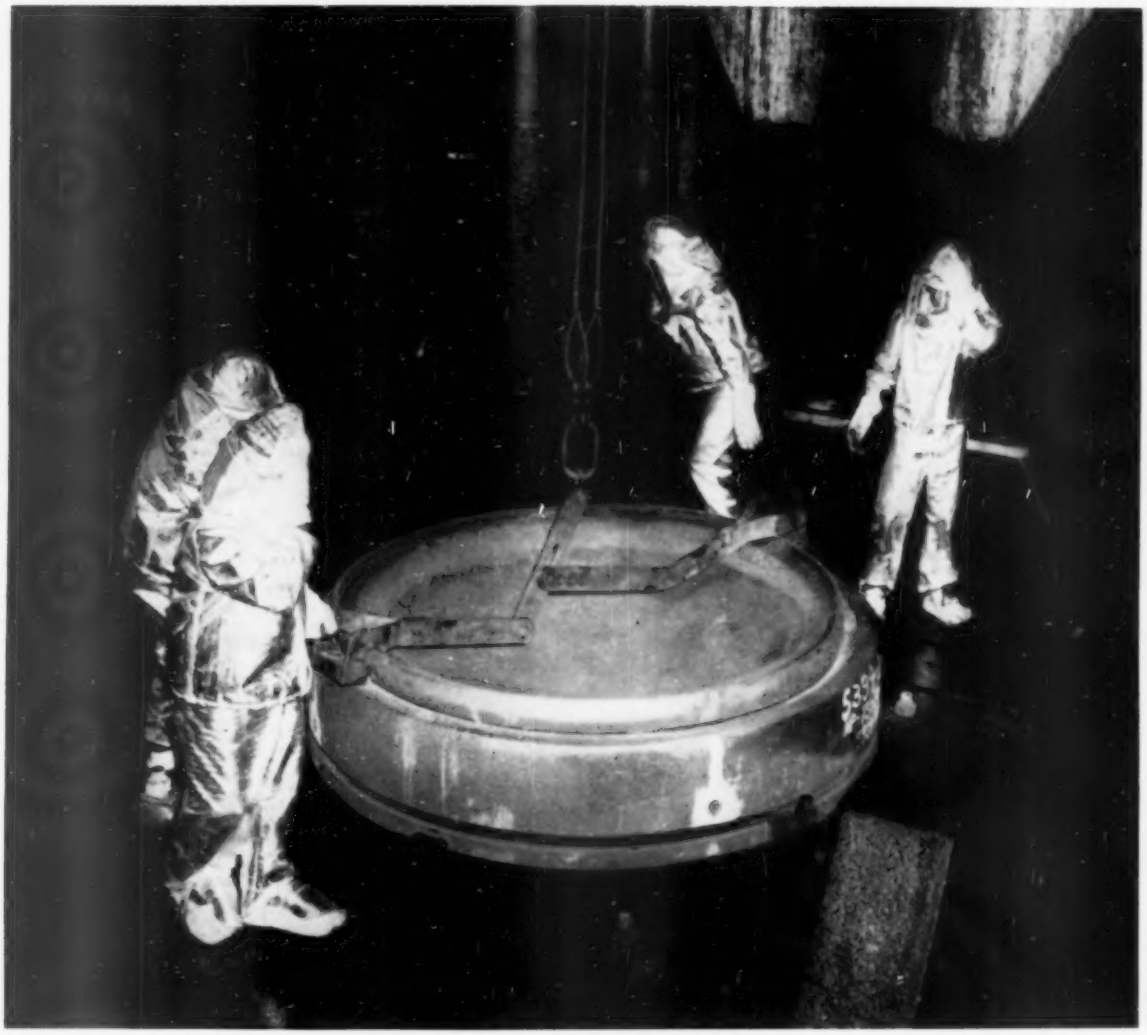


FACTORY

PLANT OPERATING MANAGEMENT

CASE BOOK

WARREN J. KING
Manager, Features and Departments



ALUMINUM SUITS WARD OFF 2000-F. HEAT AS MEN HANDLE HEAVY BERYLLIUM FORGING . . . PAGE 162

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Blankets Braze Faster, Cheaper

Snug as bugs in a rug—or in an electric blanket—are stainless steel honeycomb panels in this new brazing process. Electric blankets eliminate slow, costly brazing furnaces commonly used in honeycomb-sandwich panel fabrication. Save millions of Btu.'s and up to 17 hours of brazing time. The method is a joint development of Rohr Aircraft Inc., Chula Vista, Calif., and Electrofilm Inc. of North Hollywood.

High-temperature wire-mesh heaters embedded in a sheet of silica insulation concentrate heat next to surfaces being brazed. Principle is the same as that of the home electric blanket. More efficient heating results because you snuggle the heater up to the object you want to warm. The pile of white insulation pads makes the test layout look like a feather mattress and pillows. But it seals every corner of the brazing set-up against heat loss. Thermocouples enable operators to keep the temperature uniform for a good over-all bond.

Except for the heat source, the mechanics of the honeycomb process remain the same. Panels of two stainless steel exterior sheets, layers of copper-lithium-silver brazing alloy, and honeycomb core are prepared and assembled with meticulous care and cleanliness. They are then sealed in an air-tight muffle box filled with argon gas and partially exhausted during the brazing cycle. Carbon blocks support the panels and help diffuse the heat.

The brazing cycle raises temperature of the part to 1650 F., holds it briefly at this level, then drops it to 1400 F. for an hour and a half. Cooling and refrigeration follow. Cycle takes roughly 6 hours compared to the 23 in a large furnace. During the cycle furnaces normally consume as much as 15-million Btu.'s, but pass on only a fraction of the energy to the part.

Blankets take up less space than furnaces. And several can be run from central control systems. What's more, it's feasible to use these high-strength panels in many new applications. The process also promises to remove some of the structural and size limitations on honeycombs by permitting repairs and heat treating to be done without removing sections from the aircraft.

Shield Forged for Space Vehicle

(Cover Story)

These aluminum-shrouded men are not baking a big cookie. They're handling an 80-in.-diameter beryllium shield for a man-carrying space capsule. The heat-resistant suits protect them against 2000 F. heat from the disk in the forging die.

The 3-in.-thick shield was a joint undertaking by the Aluminum Company of America and Brush Beryllium Company, Cleveland. Brush made the giant billet for the shield from powdered beryllium by a special heat-vacuum-pressure process. It's said to be one of the largest shapes ever made by powder-

metallurgy techniques. Then Alcoa forged the saucer-shaped disk in a 50,000-ton press at its Cleveland plant. Later Brush will precision-machine the part down to a 72-in. diameter, ship it to McDonnell Aircraft Corporation (St. Louis).

The shield will protect the first spaceman from air-friction heat developed during the satellite's flight. Beryllium is used because it is strong, has a tremendous capacity to absorb heat, but weighs only a fifth as much as steel.

Insulation Tested

No predictable insulation failure gets by at United States Steel Corporation's Sheet and Tin Mill in Gary, Ind. Why? Because of a 70-kv. d-c over-potential tester used for preventive maintenance and pre-operation checks. This unit stresses insulation of high-voltage cables, pothead substation equipment, motors, and generators.

Similar techniques have been used in manufacturers' laboratories and on utility systems for several years. But use in industrial maintenance thus far has been limited. Here's how it works on a typical 4160-volt substation before it's energized for the first time:

First the area is roped off. Then testing begins, one cable at a time. The first test point is at 5 kv. Output current climbs as the cable is charged, then falls off. After current stabilizes, the value is plotted against voltage on a graph. Next the voltage is advanced another 5 kv. and the process repeated. If leakage current climbs disproportionately to the increase in test voltage, or if the stabilizing period increases appreciably, the test is discontinued until the suspect cable can be examined more closely.

This demanding (yet safe) test reveals faulty materials or workmanship before costly breakdowns in service occur. Only the electrical power foreman, electrical maintenance foreman, and utility dispatcher may use the equipment (Associated Research Inc.). Electrical safety and possibility of damage to the substation through error are the reasons for these restrictions. As a further spur to safety, output voltage falls to zero unless the operator's push-button is kept depressed.

Maximum test voltage depends on cable or equipment specifications. When lower voltage equipment is tested, test voltage increments are reduced. U. S. Steel uses the new testing equipment an average of twice a month.

Paperwork Slashed

Streamlining the handling of engineering changes saves an estimated $52,000 annually for Aeronca Manufacturing Corporation, Middletown, Ohio. The reduction in costs comes from more efficient use of personnel, paperwork, and equipment. Aeronca processes some 12,000 engineering changes per year.

Reduction in personnel resulted from better allocation of time rather than layoffs. Now three full-time men aided by a secretary review and process all changes. Used to take eight men meeting three times a week, with considerable lost time traveling to and from meetings. Also, meetings sometimes conflicted with other duties.

What's more, responsibilities of the three-man change team have been increased. They now specify the assembly number in which each change will be incorporated, then follow up to make sure changes are made as scheduled.

Reduction in paperwork cut the man-hours required just to complete forms, thus eliminated full-time support of six persons. Aeronca not only reduced the number of forms used but also cut the number of copies required. In its engineering departments, for example, the company has gained these benefits:

- Eliminated 27 operations.
- Replaced six forms with one.
- Slashed the number of copies per change by 227.

Less paperwork shuffling also has brought savings in filing, sorting, matching, indexing, and locating. In all, more than half a million sheets have been eliminated annually.

Reduction in equipment was a direct result of reduced paperwork. Over 40 filing cabinets valued at $3400 have been eliminated, freeing floor space for other uses.

"Lazy Susan" Molds Giant-Size Ingots

Big Steel (U.S. Steel Corporation, that is) has moved into the kitchen to borrow a serving-dish principle. Came out with a giant "lazy susan" that revolves to accept molten steel into its vacuum-sealed ingot molds. The process, used by the corporation's South Works in Chicago, removes most of the hydrogen from steel during casting, thus produces a better-quality steel.

Photo shows the 14-ft.-high, 16-ft.-diameter tank enclosing the "lazy susan" molds. Above, the crane holds a 30-ton ladle ready to discharge molten steel. But hydrogen must be removed from the casting unit. A four-stage steam-ejector system empties unit to an absolute pressure of about 200 microns.

Steel cast in this rarefied atmosphere, equivalent to that prevailing 40 miles above the earth, is insensitive to thermal flaking. It also has greater ductility than conventionally cast steels. Once the casting chambers are purified, steel pours into them from the ladle. As each mold is filled, the turntable rotates to the next empty mold.

QUIET "OASIS" IN NOISY PLANT AREA

Soundproof, air-conditioned offices and a conference room in the midst of a hot, noisy paper mill boost employee morale at Allied Paper Corporation, Kalamazoo, Mich. Supervisory people use the area to hold meetings and do paperwork. Formerly, they had to walk to other floors or across the street to the company's general offices. Interior walls of the office are portable partitions (GR Products, Inc.) with a perforated sound-catching surface. Exterior walls have same sound-deadening properties, but are not perforated. And in case of a new layout in the production area, offices can be dismantled and moved.

Fair Shake on Quality

A vibration test unit gives missile components the shimmies and shakes at the Air-Arm Division of Westinghouse Electric Corporation, Baltimore. It's a test to insure quality of parts weighing 150 pounds at up to five times the force of gravity.

In the above picture a missile subsystem (top) for the Bomarc Target Seeker is being put through its paces. Two similar machines at the division are used for operational testing rather than production control. According to test engineers, the machine (MB Electronics) will also be used to check systems at twice the force of gravity.

Sports Spotlighted

Two employees gain special awards each year at the Raybestos Company (Bridgeport, Conn.). One is named "Outstanding Athlete." The other receives the "Award of Appreciation" for his contribution to the company's employee recreation program.

Raybestos thinks these awards are important to employees. So important, in fact, the company recently reviewed the rules for selecting the two award winners. Then the rules, administered by the plant recreation advisory committee, were printed in the company paper. Here are the selection rules Raybestos set up:

• For Outstanding Athlete:

1. The candidate must be a company employee who has participated in one or more interdepartmental or industrial sports during the year.

2. No employee may receive the award more than once.

3. Each year's contest ends on Sept. 30.

4. If no employee stands out above others during the season, the selection committee may grant the award based on single spectacular feats, such as a hole in one, or a pitched no-hitter.

5. Sorry—no ties. The selection committee breaks 'em.

• For Award of Appreciation:

1. The candidate must be an employee who has been active in the program during the year.

2. He must voluntarily have contributed to the program.

3. No employee may receive the award more than once.

4. Contributions during prior years may be considered by the committee making the selection.

5. No ties are permitted.

For 100-Ton Loads

This king-size positioner will soon be helping Bucyrus-Erie Company weld large frames for power shovels at its Milwaukee plant. The 200,000-lb.-capacity positioner stands almost 14 feet high when its table is in a horizontal position.

Two synchronized 25-hp. motors tilt it. Similar units use a single motor and cross shafts to supply power to the tilt gears. The Worthington Corporation built the big positioner at its plant, then dismantled it for shipping. Weight, with a 16-ft.-square table, is 65 tons.

Newest Twist in Plant Phones

First stage of a new-type dialing tie-line network has been installed by Radio Corporation of America. It connects company plants and offices in New York City, New Jersey (Camden and Harrison), and Lancaster, Pa. Using it, an operator at these facilities can dial any of the 12,000 phones in the four locations —plus phones in any of the four cities. System will be extended to include all 36 RCA factories and offices in New Jersey, Pennsylvania, Ohio, Indiana, Illinois.

In planning the system with AT&T, RCA found that many installations with small toll bills were in the path of communication traffic between plants with heavy toll demands. With the small locations used as switching points in a dial network between two larger centers, calls to the small centers are combined with the main traffic at a big saving. Eventually branch circuits will be set up laterally from small switching centers to plants away from the main traffic flow. Estimated completion date for the over-all communications project is 1961.

CARRIER SPEEDS LOADING, UNLOADING

Over, lift, and away she goes—at 25 mph. That's how this straddle carrier makes light work of loads up to 40,000 pounds. It reduces cargo handling to just two operations for Oahu Railway and Land Company (Honolulu)—once when it's loaded in the aluminum containers at shipper's plant, and again when unloaded by consignee. The specially built straddle carrier (Hyster Company, Portland, Ore.) drives over highway semitrailers hauling the 8x8½x24-ft. containers. After containers are detached, the carrier's hoist frame lifts them. A 14-ft. underclearance allows carrier to raise load up to 5 feet off the ground.

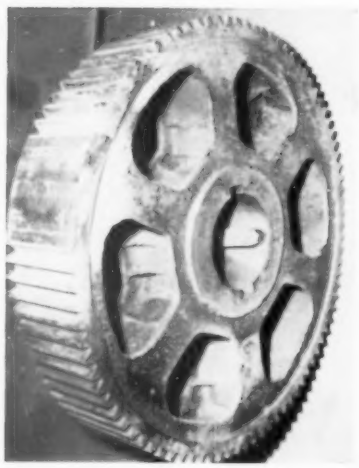


Plate Restores Worn Gear Teeth

Repair or replace? That was the $64 question when eight teeth broke on a large fabricated bull gear at Lincoln Electric Company (Cleveland). Repair costs would run to $400, replacement $900. Lincoln decided on repair—by this method:

The section of broken teeth was cut away and an 8x10-in. piece of 2-in.-thick flat tool steel was fitted into the void. This was welded to the side faces and adjoining teeth of the 45½-in.-diameter gear. Crowning the insert slightly by grinding, Lincoln gave it the proper outer surface contour. To finish the job, eight teeth were cut in the insert with a vertical hobber.

Tape Rides On Air

Gentle fingers of air cushion and control magnetic tape as it whisks through Minneapolis-Honeywell Regulator Company's new "800" computer. With this method, damage to tape moving at 10 fps. through metal rollers, clutches, brakes, and drivers is almost eliminated. Honeywell's Datamatic Division in Boston developed the new system.

It's a neat trick—and one that may have application on other devices that use moving strip or tape. Blowing starts the tape—vacuum stops it. Moving and cushioning tapes with air has an important lubricating effect. It reduces wear on the "data" side of the tape. The only metal the tape touches is the "read-and-write" head that puts 3600 binary digits on each inch.

The system also gets rid of the problem of fine dust and iron-oxide particles. Formerly, metal rollers ground these into the tape's surface. Now the air flow blows this dust out of the computer. Eliminating this hazard means that a significant increase in tape fidelity and accuracy will be available to computer users when the "800" is introduced in October, 1960.

Wives Get Tours

Wives of employees get to hang up their aprons and tour their husbands' plant at Aerojet General Corporation (Sacramento, Calif.). They can even visit the spot where Dad puts in his eight hours daily if it's not a restricted area. Tours are held Monday through Thursday evenings from 6 until 9:30 p.m. They include the

unclassified solid- and liquid-fuel rocket plant facilities.

In describing the employee relations idea Resident Manager E. E. Nelson says, "We have many employees working long hours on important projects. In the interest of good employee relations we feel wives should be able to see the vital work being done at our plants."

Aerojet has some 13,000 employees at the Sacramento plants. Of these, 11,000 are men. Tours are scheduled on a rotation system by departments. Thus all interested wives have a chance to participate. The public relations department and the office of visit coordinator take care of arrangements.

No Jam-Up Here

Nobody puts a crimp in the works of this machine. It's an automated crimping operation at the Alemite Division of Stewart-Warner Corporation (Chicago). Lubrication fittings come from vibratory parts feeders (behind operator) and travel down plastic tubes to the indexing table of the automatic crimping machine.

When fittings feed into crimping mechanism too fast, a back-up in tubes can cause jamming. To prevent this, Stewart-Warner uses a simple electronic sensing device to synchronize the operation. This proximity pick-up device fits around feed tubes about a foot above the crimping table. When fittings back up to this point, the pick-up energizes a proximity control unit. This shuts off parts feeder. But the table continues to revolve, reducing the level of fittings in feed tubes.

When the fitting backlog is relieved, the proximity control unit deenergizes and the vibratory parts feeder resumes operation. Action by the proximity device (Electro Products Laboratories) frees operator to work the crimping table.

Co-Op Training Helps Two Plants

Two companies in Albion, Mich., had a problem. Both needed training programs for their managers. But both companies were small—under 1000 employees each. So they were limited in training funds as well as instructors.

The hard-working managers in the above photo are proof a solution was found. They're at a training session. And what's interesting is the way Albion Malleable Iron Company and Union Steel Products Company solved mutual problems to make this training possible.

It's a cooperative venture. Each plant provides training for the other in a particular program that's already in operation. For example, Union Steel had the facilities and instructor for training people in work simplification. Thus, it set out to train 17 men from Albion Malleable, including foremen and department heads, in this subject. These men met at the Union Steel conference room weekly for two hours over a period of 10 weeks. On graduation, all the men received diplomas.

On the other hand, Albion Malleable has a predetermined time standards program. In turn, it trained 12 Union Steel men in the theory of predetermined time standards along with 10 of its own people. The course was taught by an assistant industrial engineer at Malleable. The exchange of ideas during the sessions was also considered healthy.

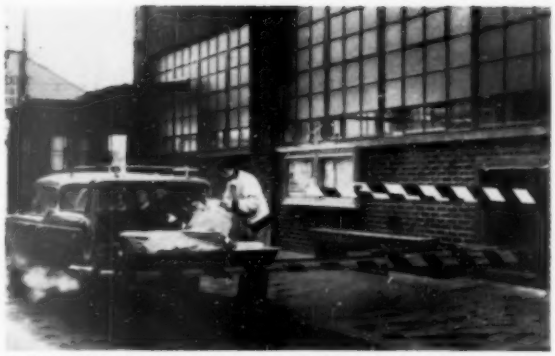
Training was done at minimum cost to both companies. In fact, the extra people added little to existing training costs. And in this way both the companies and the men have received training that normally would not have been available. The programs also provide new situations that improve the instructors' ability and experience.

Source: R. H. Behling, Chief Industrial Engineer, Albion Malleable Iron Company, Albion, Mich.

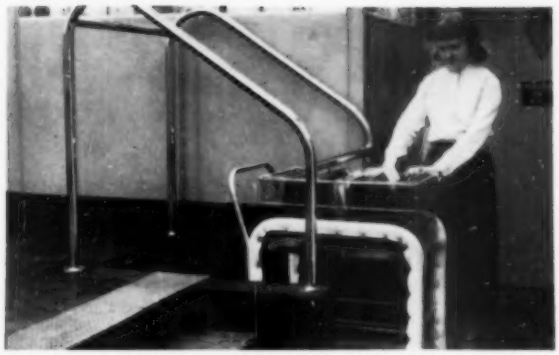
Keeps 'em Clean Under Water

Best way to keep transistor parts clean is under water. That's the way the Lansdale Tube Company, a division of Philco Corporation, does it at the Lansdale (Pa.) pilot plant. After nickel plating in the chemical laboratory, parts travel to the plant's "white room" in beakers filled with distilled water.

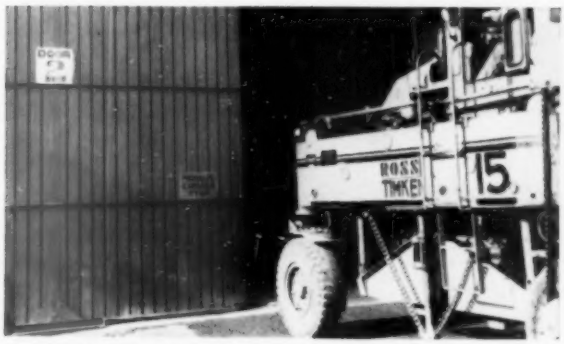
Final drying of the parts is done in an oven under a 30-in. vacuum at 100 C. This also helps to draw off any contaminating vapors left from earlier processing. After a two-hour baking the parts are put in screw-top jars ready for the assembly line. Parts not needed for production are stored in the oven.



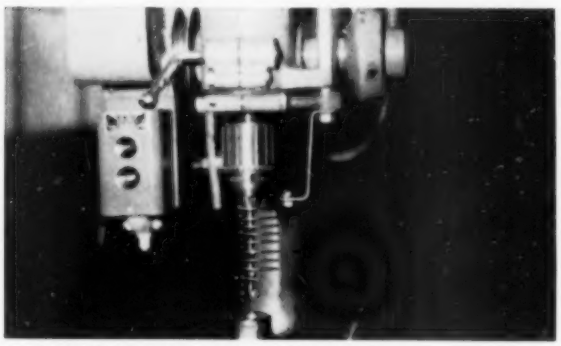
1. TELESCOPING ARM DELIVERS THE MAIL



2. "MAILEVATOR" RAISES AND LOWERS CARTS.



3. SONIC WHISTLE OPENS DOORS.



4. SPRING FORMS SAFETY SHIELD.

Four Ideas Save Time, Steps, and Trouble

Making life easier and safer for workers is one way the Timken Roller Bearing Company cuts costs. Here are four examples. The first three effort-saving devices are operating at the company's Canton, Ohio, plant. The fourth comes from its plant in St. Thomas, Ontario. Will any of these ideas make your plant a better place to work?

1. Telescoping arm delivers mail. A passing pedestrian hears a bell sound. Heeding the warning he steps to the side of the wall door at right. Then things start to happen. A door opens, and guard arms, like those guarding railroad crossings, come down. Thereafter two "arms" holding a tub extend gradually from within the building. In the tub are mail sacks.

This is Timken's contribution to more efficient mail handling. The telescoping arms take mail sacks to and from the rear of a waiting station wagon. There they're easily loaded or unloaded. When not in use, the arms retract so the tub-like carrier is inside the plant's mail room. A small foyer can be closed off by double doors to keep cold air from coming into the mail room when the outside door is open. The whole set-up has resulted in easier and better handling of outgoing and incoming mail sacks.

2. Mailevator carries carts. Split levels may increase the charm of a house. But they can make life difficult for the mail girls in a plant. They must distribute mail at all levels. But at Timken stairs are no obstacles to the girls.

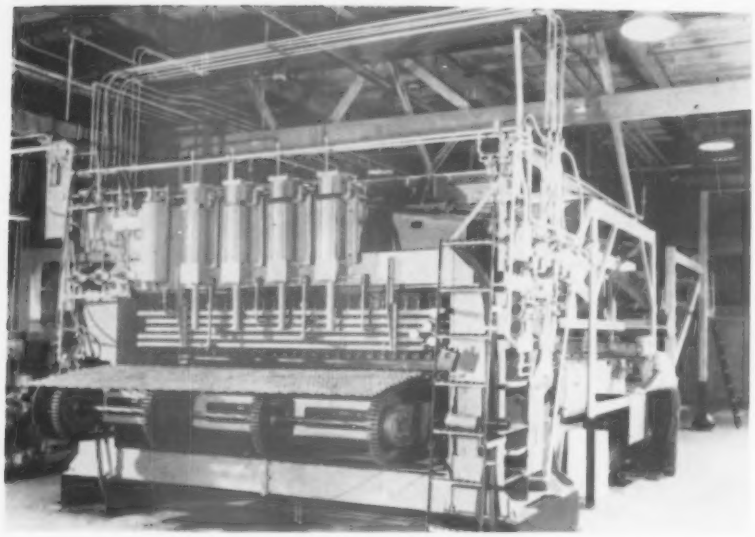
Instead of tugging mail carts up and down stairs, girls have their own small elevator. All a girl does is push a cart in place on the elevator, then press a button to move it up or down. Cart is bumpered with foam rubber to protect walls and furniture from damage. Guardrails enclose the elevator itself.

3. Sonic whistle opens doors. Straddle carriers move in and out of these doors about once every 10 minutes. But there's no need for the operator to dismount to open and close the doors. It's done with automatic controls activated by sonic whistles. Two whistles are on the carrier's cab. One opens the door, the other closes it. A receiver just above the door actuates the automatic door mechanism.

When a driver approaches the door, all he does is press a button. And since the whistle isn't within the audible range of the human ear, no one is disturbed.

4. Spring forms safety shield. There's no danger that this drill operator will be hurt by broken drills or flying metal scraps. A simple spring surrounding the drill protects him. As the drill travels down into the piece, it compresses the spring, making an effective close-meshed shield. But the operator can still observe his work through the remaining openings.

When the chuck is raised, spring expands but still forms a protective shield around the whirling drill. This gives Timken a foolproof safety device requiring no maintenance. Here the drill is boring holes in removable rock bits.



CONVERTS STEEL TO FINISHED GRATING

Now one man does the work of 24—with the help of a machine, of course. A single operator tends this completely automatic machine that produces 5000 square feet of load-bearing grating during an 8-hour shift. The job formerly required 24 men. Machine was developed by Bustin Steel Products Inc. (Dover, N. J.), after seven years of research. It accepts ⅛-in.-thick steel bars at one end, delivers standard lengths of finished grating at the other. The 10½-ft.-long, ½- to 1-in.-wide bars are first serrated, then corrugated to form grating of various designs. The 28 sets of pincher-type guns weld the bars automatically.

Helping Hand for Budding Scientists

One industrial firm in Southern California is wondering whether it should allow a teenager to build a nuclear reactor in its plant. How did the subject ever come up? Well, it's just one result of a unique community-industry program to help science-minded youngsters prepare for advanced study.

Various industries in the area of Orange County, in cooperation with the National Explorer Committee of the Boy Scouts of America, are giving the time of their scientists and after-hours' use of their facilities to this project. One or two industries sponsor activities in each Science Explorer post that is organized. Robertshaw-Fulton Controls Company's Western Research Center, for example, is cooperating with the nearby research center of U. S. Borax and Chemical Corporation by taking a Science Explorer group under its wing.

Each member of an Explorer group undertakes a project of his own choosing. Regular meetings are held at the participating plant. Members report on the progress and problems of their projects. Key scientists from the sponsoring firm sit on the sidelines during the discussions. They offer advice where necessary, are available to help the boys if they hit snags during the construction of their projects.

Built on the Ground

High cooling-tower maintenance. Higher labor and material costs. Too much downtime. All these signs pointed to the need for a fan cylinder replacement program at Union Carbide Chemicals Company.

The wood collars on 82 cells of six cooling towers had been in service for up to 10 years. They needed replacement badly. The first two units were rebuilt right on the cooling tower. The work was tricky and dangerous. Labor costs ran 40% higher than the original job estimates. And the tower was out of action for days during construction.

On the next try Union Carbide engineers decided to erect collars to specification on the ground. When the unit is ready, a huge hoist (photo) lifts it to the cooling tower, where two men secure it in position rapidly. Result: Downtime averages only four hours per unit. And labor costs are cut in half when erection is done on the ground.

Two platforms with the collar layout painted on them act as semi-permanent templates. This simplifies the early stages of construction. The plant keeps two three-man crews (two carpenters and one helper per crew) on the job until 12 collars are completed. Then these units are installed all at once. One experienced crew can erect one complete fan collar at the ground level in just three days.

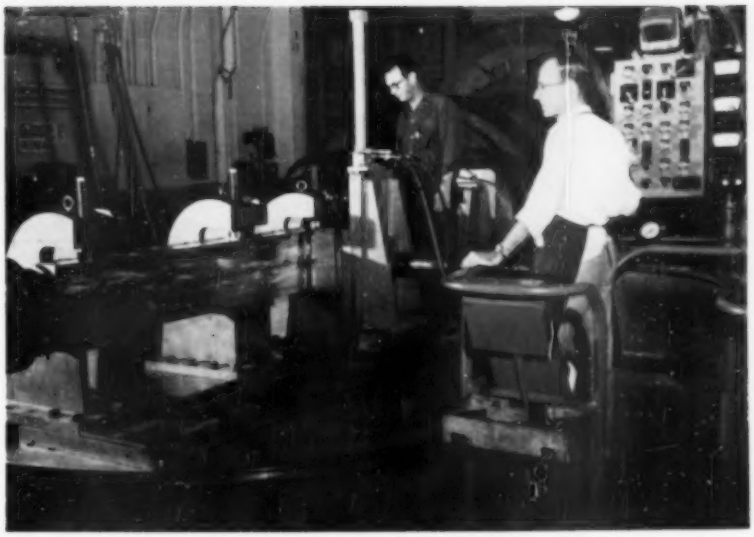
Source: G. R. Halter, Maintenance Engineer, Union Carbide Chemicals Company, Texas City.

Tee Off With This?

You'd need an extra long driver and a giant golfer to tee this one off. It's an inflatable radome, not a golf ball. Convair Division of General Dynamics Corporation (San Diego) uses it like a muff to keep ice, sand, snow, dust, and wind out of the big

ears of the listening-post radar antennae it is constructing.

The radomes, from 12 to 13 feet in diameter, are huge, flat-bottomed balloons made by Muehleisen Manufacturing Company, San Diego. A synthetic rubber coating over the Dacron makes them waterproof. This radome is resting on a circular concrete pad while it's being checked for shape and quality of construction. Trap door at right leads through pressure lock to interior of dome. Valve at left of door controls blowers for inflating dome to pressure of 0.1 psi. Mounted atop radar antenna towers, domes withstand winds of over 100 mph.



CREASES A T-SHAPED FORM "TO A T"

This machine does a fine ironing job on jet transport parts for Convair Division of General Dynamics, San Diego. Here it's being used to "iron" a short, structural beam in the shape of a T. When complete, the cross-section will resemble the alphabet letter to a T, even to the drooping ends of the cross bar. Jaws of the radial draw-former grasp the beam at both ends while a third jaw moves in to smooth the whole beam by moving back and forth over its length. Machine, built by Cyril Bath Company (Solon, Ohio) is the largest of its type in the world. Normally it uses one of the big semi-circular forms (background) to wrap form belts.

Good Plugs Glow

This test operator on Philco Corporation's high-speed radio and television line in the Philadelphia plant is inserting a chassis power cord into a new kind of nylon socket. It glows by itself when it's operating properly, goes out when there's no power at the plug.

Two sockets and a fuse are mounted at each test station. The plug bodies then screw into each socket. Philco used to wear out 1100 phenolic or hard-rubber plug bodies a week during full production. And if a fuse blew, the tester had no way of knowing it. Thus radio and television sets could be rejected because sockets were dead. A maintenance man checked each fuse twice a day with a test lamp.

The new translucent nylon plug bodies answer the double problem of breakage and bad fuses. When the fuse pops or the plug body becomes loose, the neon lamp inside the plug goes out. Then the tester simply shifts operations to an adjacent work station. Fuses are checked visually in just a few minutes. And plug body failure has dropped to 50 a week, thanks to the new plug designed by Industrial Devices, Inc., (Edgewater, N. J.).

Payoff Formula for Summer Cooling

How much must worker efficiency increase to justify air conditioning? To help managers answer this common question, the Typhoon Air Conditioning Division of the Hupp Corporation (Brooklyn) has worked up a formula. It gives the minimum efficiency increase needed to justify air-conditioning investment.

This figure is obtained by dividing cost of owning and operating air-conditioning equipment by payroll costs during cooling season. Payroll costs are reduced to dollars per square foot of area to be cooled. Same per-square-foot basis is used for equipment costs. Payroll figures include fringe benefits as well as base pay. Cooling season ranges from 10 to 35 weeks depending on geographical location.

Cost of owning and operating the equipment includes initial investment, depreciation, and operating costs. Installation cost depends on the building, but Typhoon engineers say $1 per square foot is a fairly accurate estimate for most package installations. Adding to this the per-square-foot cost of depreciation at a 5% ten-year straight-line rate, plus insurance, taxes, and power costs, gives you the total figure. Dividing this by the per-square-foot payroll cost provides the increase in efficiency needed to justify the purchase.

Typhoon claims the minimum required efficiency increase will range between 2 and 5% for the cooling season. Typical figures developed by independent research organizations show increases of 22 to 28% in manufacturing, 35% in offices, 51% in drafting rooms. You'll probably make your decision primarily on lower payroll cost per unit of output. But don't forget air conditioning improves morale, reduces turnover and absenteeism.

YOU BE THE ARBITRATOR

THE CASE OF

The Outside Interest

Out of the experience of the American Arbitration Association

Stanley D. was a maintenance mechanic in a metal wire and screen plant. At the same time he conducted a thriving contracting business on the side. Whenever a homeowner in his neighborhood needed a new garage built, a lighting system installed, or a driveway paved, Stanley did the job. In the course of one year, Stanley had so much outside work that he not only absented himself often from his regular job, but also hired a part-time helper.

By the end of the year, management was getting fed up with this state of affairs. And when Stanley phoned one morning to say he'd be out that day, the personnel manager had him fired. The union promptly filed a grievance. Claimed the reason for absence that day was his wife's illness.

"I wanted to explain this to the watchman who got my phone call," Stanley testified, "but he hung up on me."

"We don't believe it," answered the personnel manager. "You're trying to misrepresent your absence, which is just another reason why you deserve to be fired. And if the watchman did hang up on you, why didn't you call him back to offer your explanation?"

At this point the union's international representative cut in: "This issue of the phone call really has nothing to do with it. You didn't fire him because of alleged misrepresentation. You fired him because of his outside work. But that's something you've known about and tolerated all along. So what gives you the right to get tough about it all of a sudden?"

Eventually the case went to arbitration. Suppose you were the arbitrator. How would you rule?

For the actual decision turn to page 176

Half as Many Off-the-Job Injuries

A survey revealed employees suffered injuries off the job far more often than on the job at California and Hawaiian Sugar Refining Corporation (San Francisco). The safety committee recommended—and management implemented—a second safety program. Its name: "C & H Employees Off-the-Job Safety."

The committee heading this new program meets bi-weekly. It's responsible for providing a monthly mailing of suitable material to all employees' homes, conducting safety contests (savings bonds as prizes), placing free literature in racks near plant entrances, and providing guest speakers to local civic groups. The committee also assists civic groups in safety projects.

Has this "Off-the-Job" program been effective? B. L. Lonsdale, safety director for the corporation says: "At the present time C & H employees have less than half as many off-the-job injuries as they had prior to the program. During this same period on-the-job injuries also showed a substantial reduction."

Air Guards Glass

A stream of tiny air jets is solving a bothersome problem at Ryan Aeronautical Company's San Diego plant. Saving a little money, too—about $10 per week. How? By deflecting sand that used to spatter against the glass window in the company's sand-blasting cabinet.

The improvement uses a perforated tube placed so it directs many small air blasts across the inner surface of the cabinet's glass viewing window. This minimizes the impact of the sand on the glass. Impact formerly pitted the glass, thus distorted the operator's vision.

It wasn't a costly problem, just a troublesome one. Required up to six glass changes per day. Now changes average only one a week.

Saving With Scooters

A fleet of 10 scooters provides motorized protection at Westinghouse's East Pittsburgh plant. Saves the company roughly $80,000 annually. Three years ago, the switch from foot patrols to motorization was made for an $11,000 outlay. This included cost of 3-wheeled scooters, charging equipment, heavy-duty batteries, and accessories.

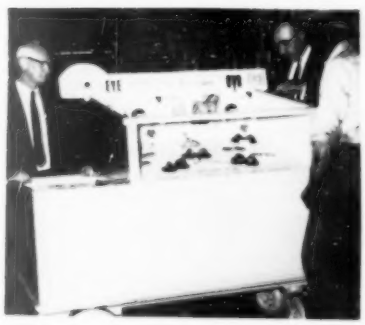
Vehicles patrol much of the 6-million-sq.-ft. plant during non-

working hours. Their average speed of 8 mph. is three times that of guards on foot. Patrolmen riding scooters can see as well as foot patrols—and average twice the coverage per shift. Foot patrols still cover areas not accessible to scooters.

When scooters first went into operation, Westinghouse encountered one drawback. Storage batteries powering the units weakened quickly. But reinforcing scooter frames and equipping them with heavy-duty batteries soon solved this problem. Now quick chargers restore full battery power in four hours.

Two scooters are always kept in reserve in case breakdown or recharging puts one of the fleet out of service. Westinghouse feels the switch to motorized units provides greater protection against pilferage, sabotage, and fire hazard. And the insurance carrier agreed in approving the changeover.

Source: C. J. Zetler, Jr., Plant Engineer, Westinghouse Electric Corporation, East Pittsburgh.



Mobile Teaching

This mobile display moves on a predetermined schedule to 13 locations in the Bullard Company plant in Bridgeport, Conn. It remains in each location for one day. Purpose: employee education.

The wagon features a large glassed-in display case. Easy removal of the sliding Plexiglas panels facilitates setting up and removing display materials. Attached is a tray for literature about the subject displayed.

Bullard changes displays every three weeks. The one pictured above deals with safety. Others will cover machine rebuilding, vacation safety, hospitalization benefits, product cost, quality control.

Furnace Rides Rails

How do you braze an extra-long piece of honeycomb wing section for a B-70 bomber? Build a long furnace? Or push the length through bit by bit? Solar Aircraft Company solved the riddle by building a traveling furnace. It automatically moves down the length of the piece, brazing as it goes.

A pilot model is already in operation at Solar's San Diego (Calif.) plant. A production model will soon be finished. The system utilizes an electric brazing furnace with vacuum and atmosphere controls. It has a high-temperature brazing capability of 2100 F.

The furnace is open at both ends and straddles the work. It moves over the parts at a pre-set speed that combines with regulated temperatures to provide the proper brazing cycle. A production rate of 1 fpm. can be achieved on lengths up to 24 inches wide.

Station movements of parts are eliminated in preparation and brazing. Solar officials expect the system to play an important role in automated honeycomb and sandwich section production.

Contributions from readers reporting experiences will be welcomed. No need for fancy writing; just a clear, concise statement of facts. If you have photos or drawings, be sure to include. We'll edit for the Case Book. Contributions accepted will be paid for at time of publication. Address: Case Book Editor, FACTORY, 330 West 42nd St., New York 36.

CASE BOOK CAPSULES

Microstoning attachment produces mirror-like finish to 0.5 microinches on hard materials, 1 to 2 microinches on soft. Licensed to Taft-Peirce Manufacturing Company (Woonsocket, R. I.) by West German firm. Works on metal, some plastics, hard rubber, glass.

Electronic translator unscrambles computer language, prints or displays on TV up to 20,000 letters, numbers, or symbols per second. Videograph (A. B. Dick Company, Chicago) can scan in one spot, print in others miles away.

High-energy electron beam welder joins reactive or refractory metals in a high vacuum (NRC Equipment Corporation, Newton, Mass.). Gun is fully protected from gaseous discharges in weld area.

Winning suggestions can be worth twice as much to employees at General Motors (Detroit). On May 1 maximum award for ideas that improve operations was doubled. New maximum: $5000.

Automated data retrieval system selects one out of a million file cards in seconds. Dialing a code number starts system (General Precision Laboratory, Pleasantville, N. Y.). Closed-circuit TV transmits to point of use.

Mass-production silicon solar cells can convert into electricity 10% of sun's energy striking them at 100% of energy conversion efficiency, says Hoffman Electronics Corporation, Evanston, Ill.

Atomic clock for orbiting satellites is under development by Hughes Aircraft Company (Culver City, Calif.). It will check effects of gravity on atomic processes. Superaccurate—won't gain or lose one second in 1000 years.

Measuring damage to crates and boxes during shipment can be done with a rail-car hump track devised by U. S. Army Engineers (Fort Belvoir, Va.). Tests effects of bumping, etc., during switching.

Ideas? Dial 321

It's easy for employees to get cost-cutting suggestions on the record at Revell, Inc., Venice, Calif. And just as easy for them to blow off steam. All they have to do is dial 321 on the nearest phone. An Electronic Secretary on the line's other end takes the message.

The device automatically answers the phone, records the caller's message, and hangs up. Later, management plays the messages back, makes notes of sound suggestions or beefs. Revell hopes employees will call up and put good ideas "on the record" before they forget them. Feels many good ideas are lost because employees are too bashful or don't have time to write them down.

No-Hands Precision

At least no human hands. And some day soon a mechanical marvel that looks like this machine may take over the complex manual tasks in your plant. Called a tape-controlled manipulator, it's already been used experimentally to spray hot castings. It does a perfect job every time. Never gets tired, wastes paint, makes mistakes, or quits early.

Engineers at the Borg-Warner Research Center, Des Plaines, Ill., built the tape-controlled unit shown here. The arm is similar to the remote-control manipulator B-W built for handling radioactive materials. But its movements follow directions on the magnetic tape.

Here's how it might work when spraying hot bathtub castings: A skilled spray operator manually would guide the arm through all spraying steps the first time. This would be the machine's "learning" cycle. Meanwhile, the magnetic tape would record each movement of the arm. Once a perfect job was on tape, the arm could duplicate every movement perfectly. And duplicate tapes could be made in any quantity.

Hunch Bars Fire

"About half the die-casters use a flammable oil. The other half use fire-resistant hydraulic fluid. Don't believe there's any danger in using a flammable oil in your new die-casting operation." That's free advice that managers of the Cambridge Tool & Manufacturing Company are glad they *didn't* take.

To these men it didn't seem logical to put a potentially dangerous fluid in a machine with molten zinc and aluminum near by. With pressures up to 1000 psi. in the machine hydraulic system, leaks or ruptures would spray the fluid into the molten metal. So company engineers played a hunch and used a fire-resistant fluid (Shell Oil Company's Irus Fluid 902).

It was a good hunch, too. The new machine completed one job. It had cast two pieces on the next job when the main cylinder failed. Hydraulic fluid instantly sprayed over the room. The operator quickly stopped the pumps, but in four seconds 95 gallons of the machine's 165-gal. capacity had drenched a 2000-sq.-ft. production area with a fine air-oil mist. There was no fire. But if the system had been charged with conventional mineral oil, there surely would have been a fire, an explosion, or both.

Cambridge had to do a mammoth cleaning job, but the only real damage was to the caster cylinder. The small extra cost of fire-resistant fluid saved plant damage—maybe lives, too. Since resuming operation Cambridge engineers have observed the fire-resistant liquid under normal operation conditions. They find its lubricity equal to other hydraulic fluids. And its bright yellow color makes leaks easy to spot.

Source: William Martin, President, Cambridge Tool & Manufacturing Company, Somerville, Mass.

TV Watches Kilns

Until recently there was only one way to find out what was happening inside a cement kiln: peek through the porthole. Key men in the mill had to work under uncomfortable and unpleasant conditions so they could make an occasional kiln observation. Observation-port temperature is about 2100 F.

The problem was solved by a specially designed TV monitoring system at Ideal Cement Company's new Houston plant. Using a cold cathode picture tube, the camera is mounted at the burner (output) end of the kiln. It views combustion and clinker formation through a heat-resisting glass port cooled by a blast of air. The camera is also air cooled. For added protection a compressed-air supply is held on standby in case regular blower fails.

Coaxial cables connect the monitors (photo) to the cameras some 150 feet away. One operator spots changes in clinker formation in kilns, makes necessary adjustments, supervises instrumentation, and maintains optimum product quality without leaving the air-conditioned control room. Diamond Power Specialty Corporation (Lancaster, Ohio) designed the system.

1. PLASTIC PROTECTS PRECISION TOOLS.

2. SQUEEGEE CLEANS FROM AFAR.

3. TRAILER PUTS OFFICE ON WHEELS.

4. CHARGE-A-PLATES SPEED CHECKOUT.

Anywhere Is a Good Spot for a Better Way

In maintenance. In production. Or in the office. It doesn't matter where you work, if you look around you're sure to discover opportunities to cut costs through better methods. For example, here are four ways Lockheed Aircraft Corporation has improved operations at its Marietta (Ga.) plant:

1. Plastic protectors. Precision tools no longer are damaged in bins or in transit to and from repair shops. A low-cost plastic film protects them. A melting pot, installed at each tool crib, holds 20 pounds of hot, liquid plastic compound. As cullers, end mills, reamers, taps, and all drills over ½ inch come into a crib from the floor, they are dipped in the 350 F. plastic bath. The resulting plastic coat is clear—identification numbers of tools can be easily seen through it. To keep pot free of contamination, plastic is changed every two weeks before it can discolor and turn dark. Total cost of each melting pot was $100; of plastic, about 55¢ per pound.

2. Squeegee cleaner. You'll wonder why you never thought of this quick, easy way to clean high-up incandescent lamp reflectors. Lockheed maintenance men can clean eight reflectors as quickly as they used to clean one. The home-engineered tool consists of three steel flanges welded to an 11-ft. length of ½-in. steel pipe. Then 2-in.-thick sponges are bolted to flanges with wing nuts.

This tool eliminates ladders, removal of reflectors, and hand washing. In tool's center is a spring-loaded rubber plunger that fits over the empty socket, prevents water from contacting circuit. Based on principle of store-front awning cranks, a free-turning spinner handle allows operator to hold tool steady with one hand, turn crank with other. Once tool is in place over light, operator turns squeegee pads, saturated in detergent, around reflector. A fast dip in a bucket of

rinse water and a second wipe finish the job. Tool costs only $10. Lockheed uses a similar device to remove bulbs before cleaning starts.

3. Offices on wheels. With nine office-equipped trailers (Photo 3), production foremen and superintendents operate right where they're needed. Sprawled over a 45-acre production area, Lockheed's aircraft projects used to create many an administrative problem. Offices had to be maintained away from the project, or makeshift offices had to be built on the scene. In the latter, noise level was high, comfort-level low.

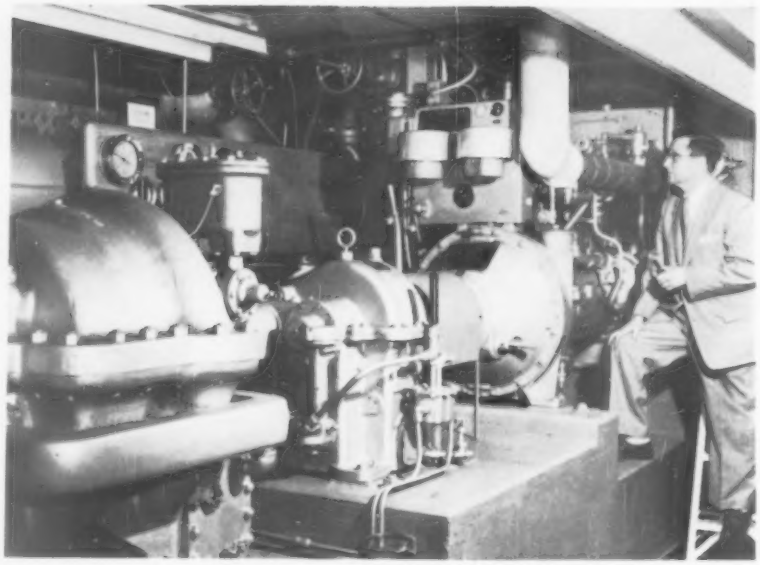
Now things are different. As project locations change or production lines shorten, trailer offices follow. A tow truck pulls them quickly and easily from old location to new. Trailer's cost about $5000 each, hold up to four people.

4. Charge-A-Plates. These help worker get needed tools faster at Lockheed's 26 cribs. And they help the company maintain closer accountability. If a tool is missing, locating it is simple with this system.

The operator (Photo 4) has inserted his personal charge plate in the printing machine outside a tool crib. This stamps his name, number, and department on a two-part form. Then he fills out tool description, date, and inspection-control number. This done, he enters crib, picks out tool he needs, hands form to crib attendant. After checking pertinent information on the form, the attendant initials it and returns carbon to the operator. Original is filed by the operator's number. When the operator returns a tool with his carbon of charge-out slip, the attendant pulls the original slip and returns tool to its crib.

If an employee leaves the company or changes departments, tools charged to him can be traced from original slips. Charge plates also eliminate confusion over illegible handwriting. Old system of tool withdrawal required more crib attendants and provided inadequate tool-checking records.

Reprints of the Plant Operating Case Book are available. Price 50¢. For quantity prices write Reader Service Department, FACTORY, 330 W. 42nd St., New York 36.



NATURAL-GAS ENGINE RUNS WATER CHILLER

Everybody's heard of cooking with gas. Well, the Milwaukee Gas Light Company is using gas for cooling at its headquarters office building in Milwaukee. Natural gas cools air-conditioning water through a centrifugal compressor cooler powered by a gas piston engine. Cooling capacity of the system is 150 tons. The gas engine is used in place of the electric motor or steam turbine conventionally used for this purpose. It was originally installed to dramatize the versatility of natural gas as an energy source. But costs compare favorably with costs of other systems. At the company's 6¢-per-therm rate for gas used for cooling, gas is the equal of electricity bought at a 1¢-per-kilowatt rate.

Corrosion Speed-Up

Would you paint corrosive chemicals on your car? Probably not. But quality control technicians at Ford Motor Company (Dearborn, Mich.) are doing it here for your benefit. It's a test to determine resistance of finishes on metal parts.

Corrodkote, a paste with consistency of cake batter, cuts 83% off the time required to test these parts in a salt-spray cabinet. Once the paste is applied, parts go into a high-humidity cabinet for 16 hours. To obtain the same results with salt spray required 96 hours. Thus in less than a day parts get the same punishment the family car takes during several months of winter driving on salt-covered roads.

Quality at Source

Visual inspection of a welded joint doesn't tell much except that the joint has been welded. Only sure way to tell a good weld is to cut it apart. And only sure way to tell a good job of magnetic particle inspection is to do the job all over again. But multiple inspection drives costs up. Naturally, the best way to get good quality is to get the job done right by the welder or inspector the first time.

Quality men at Nortronics Division of Northrop Corporation (Hawthorne, Calif.) faced this problem squarely. They set up a skilled-

MEMORY MARVEL SPEEDS PARTS HANDLING

Thousands of parts for material handling equipment in plants and 17 branches are cataloged and inventoried electronically by this IBM Memory Marvel, the RAMAC 305. It's now in operation at Yale & Towne's Philadelphia headquarters. The electronic brain can store up to 5-million bits of information about parts inventory and accounting data. It inventories parts, computes their demand, then re-orders them. Does clerical operations like pricing and billing seven times faster than manual typing from punched cards. System ties in with Yale & Towne's IBM production control and purchasing programs. Result: finger-tip control of inventory, quicker service to customers.

certification program for electronic soldering, magnetic particle inspection, dye penetrant inspection, fusion welding, burnishing, circle T stamp operation, heat treating, bearing, stacking, potting electrical connectors and coaxial cables. Results after one year showed success. Workers are known to be competent. They are their own inspectors.

Here's a step-by-step rundown on how the program was developed:

1. Quality control requested management approval to operate a personnel certification program.

2. Quality control circulated a bulletin to departments affected. The bulletin gave a rough summary of the program involved.

3. Details were ironed out in a series of meetings among representatives from quality control, manufacturing engineering, and industrial relations. Manufacturing had misgivings, felt the program would be resented by workers on the grounds that their ability was being doubted. Industrial relations was made responsible for putting the program in proper perspective to workers and providing training where necessary.

4. The following plan evolved:

• Interim certification. Since it is impractical to shut down an operation while a man attends school, an interim certificate is issued. The holder is allowed to perform his job with the stipulation he must undergo a certification test within 30 or 60 days (depending on the process involved). This test will prove his capabilities to perform work to specification.

• Regular certification. Given to workers who pass tests or complete the course offered. If the interim-certificate holder fails to pass the initial test, he is sent to school and is then tested again.

• Transfer. If, after the schooling, the worker still can't pass, he is transferred to an operation that doesn't require certification.

• Probationary certification. If circumstances indicate the tests were not a valid measure of the man's ability, he is issued a probationary certificate. This allows him to continue in the job—under surveillance. And, within 30 days after the school test, he is given an on-the-job test. If he passes this he gets a regular certificate. If not, he is transferred.

• Follow-up. Quality control checks periodically to make sure only certified people are performing certifiable functions. Also periodic reviews make sure the certified worker maintains his high standards.

Baby Blueprints Save Dollars

One way to reduce the cost of handling paperwork is to cut down on its size. At San Francisco Naval Shipyard blueprint dimension has been cut 50%. This means over-all size has decreased 75%.

The volume of paper and prints required to provide shops and offices with blueprints of a modern warship is staggering. A recent conversion job took 715,000 copies—or 55 tons of paper. Now the shipyard runs blueprints through a continuous-flo camera to reduce size, saves an ave age of $7 per drawing printed. 1958 this added up to $58,000 f blueprinting costs alone. Small size also saves filing space and handling.

With drafting practices geared to the new system, nearly 80% of drawings are reduced. This will result in additional savings of $7000 a month, or as much as $80,000 for 1959.

Siren Saves Motors

Crane motors in the coil storage area at Ford Motor Company's River Rouge plant run almost continuously. Duty on the 60-hp. crane bridge motors is so severe that separate ¾-hp. blowers are necessary.

Blower motors used to burn out. A short time later there were two motors to replace if the blower trouble wasn't discovered. Production was slowed. Situation occurred an average of once a month.

But not any more. An electrically driven siren that sounds above any shop noise has solved the problem. A relay in the blower motor circuit kicks in the siren whenever the motor fails. Now crane motor failures are down to two a year.

Dual Approach to Feeding

What's the best way to feed employees? Vending machines? Or a cafeteria? Why not combine the two and please everyone? That's what many plants are doing. And here are two examples of the result.

General Electric Company's Specialty Control Department at Waynesboro, Va., employed only 150 people when operations started in 1954. Cafeteria-style food service, as originally planned, would have required heavy subsidies. Instead, full-line vending was installed in the dining area, with provision for the addition of a counter.

Patronage was excellent—averaged 90%. But several factors were at work. The plant was in a relatively remote area. Employees had only a half-hour lunch period. And a plant rule restricted all eating on premises—including bag lunches—to the cafeteria.

By 1958, 950 employees were working—around-the-clock operations. At this point G-E installed a 16-ft. counter with a deep-fat fryer, hamburger grill, three-compartment sink, and display area for salads. But no vending machines were removed. Thus workers in a hurry can still get a complete meal automatically. Both machines and the counter use paper cups, plates, and containers. Employees readily accepted paper service, once its value in eliminating dish washing and handling had been explained to them. But objections were raised to the use of plastic tableware. It was replaced with stainless steel utensils.

Employee-relations people at G-E are enthusiastic about the use of a short-order counter plus full-line vending. "It's an excellent solution for plants with fewer than 1500 employees, most of whom are hourly rated and have a short lunch period," says F. T. Clarke, consultant on employee relations for G-E. "I recommend it strongly within our organization. We now use it at plants in Lynchburg (Va.), Scranton (Pa.), Cleveland, and others."

M. Lowenstein, a major textile converter, found patronage increased over 30% after a short cafeteria counter was added to full-line vending. The fully automatic cafeteria, handsomely designed and decorated, was opened in 1955 at the company's 1000-employee New York City headquarters. Employee reaction was immediately enthusiastic. About 600 employees regularly patronized the cafeteria. The company considered this good for in-plant feeding in New York City.

By the summer of 1957, however, the number had shrunk as the novelty wore off. The company then replaced four of the 11 food machines with an attended serving counter. Why? Because employees felt a need for a more personal touch in their food service. They felt that the usual pleasant mealtime routine was missing with vending machines.

Coffee, pastry, sandwich, tea, and hot chocolate machines were replaced. These foods were made available at the counter, along with hot dishes, a variety of main-dish salads, fancy pastries, desserts. With paper cups and plates, plus plastic flatware, everything is disposable. Employees—most of whom are women—bus their own dishes into trash receptacles around the room.

YOU BE THE ARBITRATOR

Continued from page 170

The award—The arbitrator reinstated Stanley but without back pay. Put him on notice that further absenteeism caused by outside work would result in discharge. In the present case he ruled that the outside contracting work, by itself, did not justify discipline, especially since the company had tolerated it in the past. But he did not consider the grievant blameless, especially regarding the phone call.

Caution: The award in this case is not an indication of how other arbitrators might rule in other apparently similar cases. Arbitrators do not follow precedents. Each case is decided on the basis of the particular history, contract, testimony, and other facts involved.

Scentless Room Aids Sniffers

Many industries have dust-free rooms. Here's a smell-free room. It's nicknamed the "sniffery" by perfumers at Shulton, Inc., Clifton, N. J. There a staff with trained noses evaluates the fragrance of aromatic chemicals, perfumes, and toiletries.

A special ventilating system insures a continuous supply of odor-free air, changes room air every minute. New supply enters through a draft-free diffuser in the ceiling. Old air exits through a louver in the sealed door. A 450-cfm. blower maintains a positive pressure inside the room so outside odors can't penetrate leaks.

Intake air is blown through a filter containing about 45 pounds of activated carbon. This traps and absorbs vapors and odors. It has about a 10- to 12-month life.

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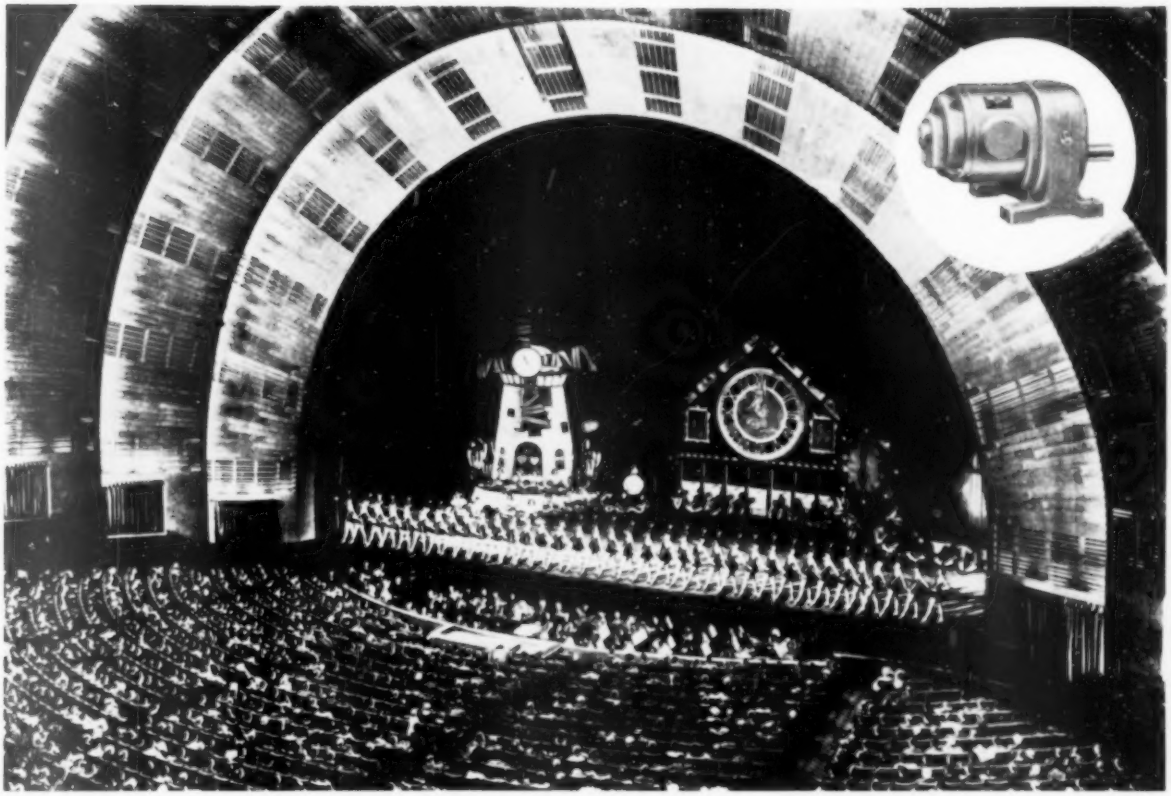

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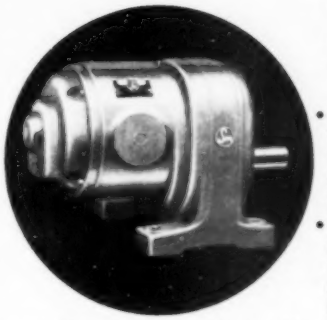

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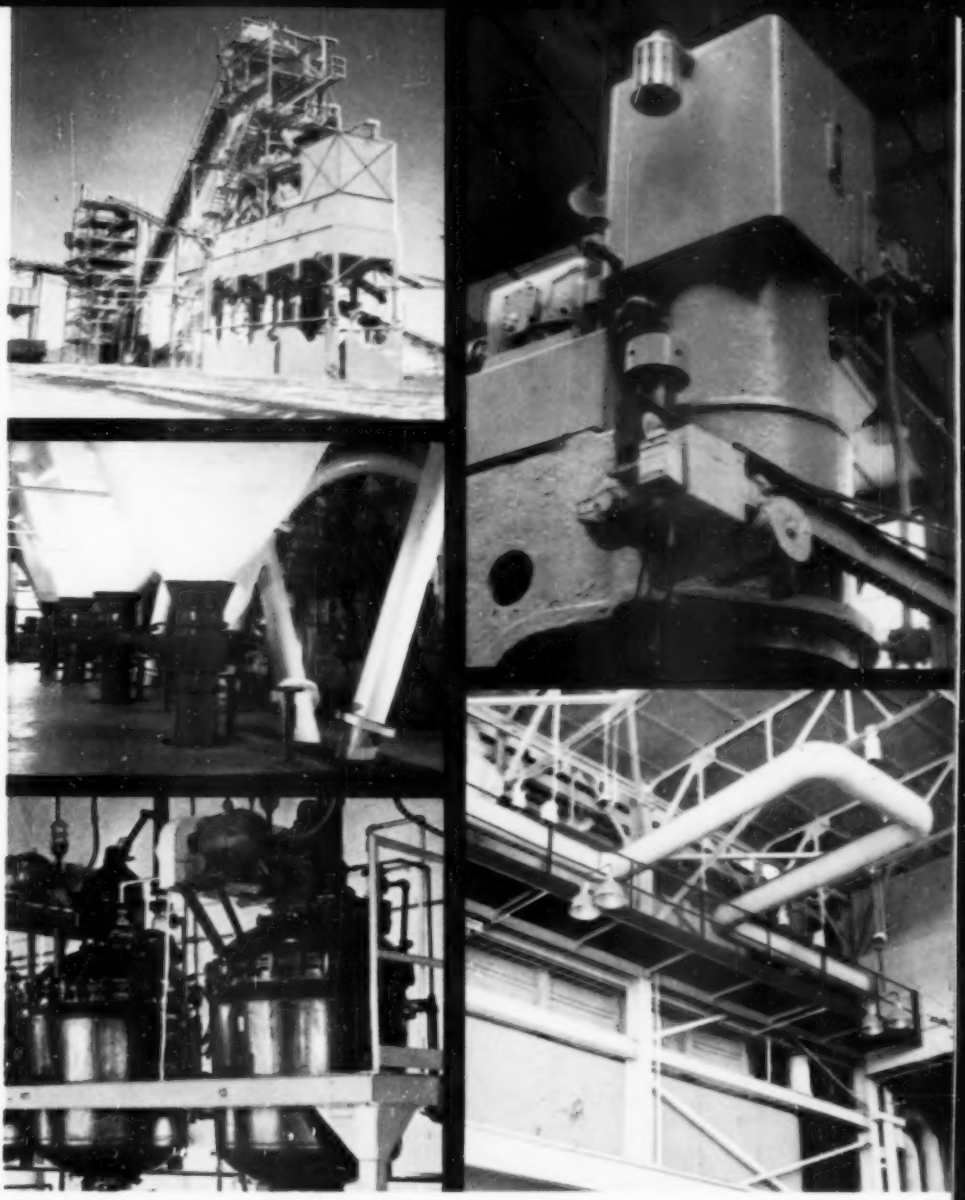

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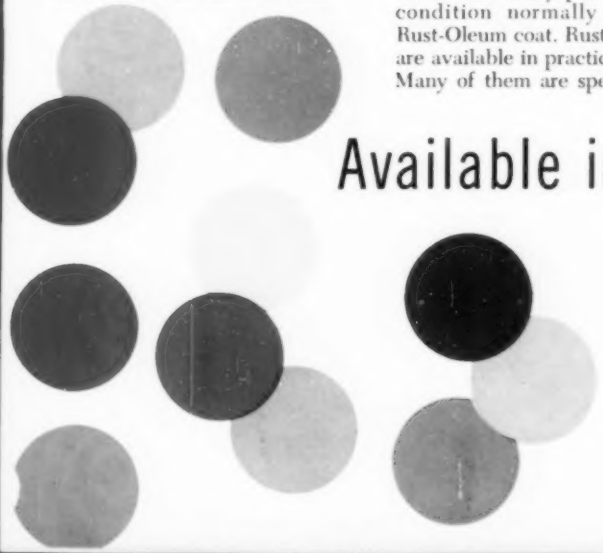

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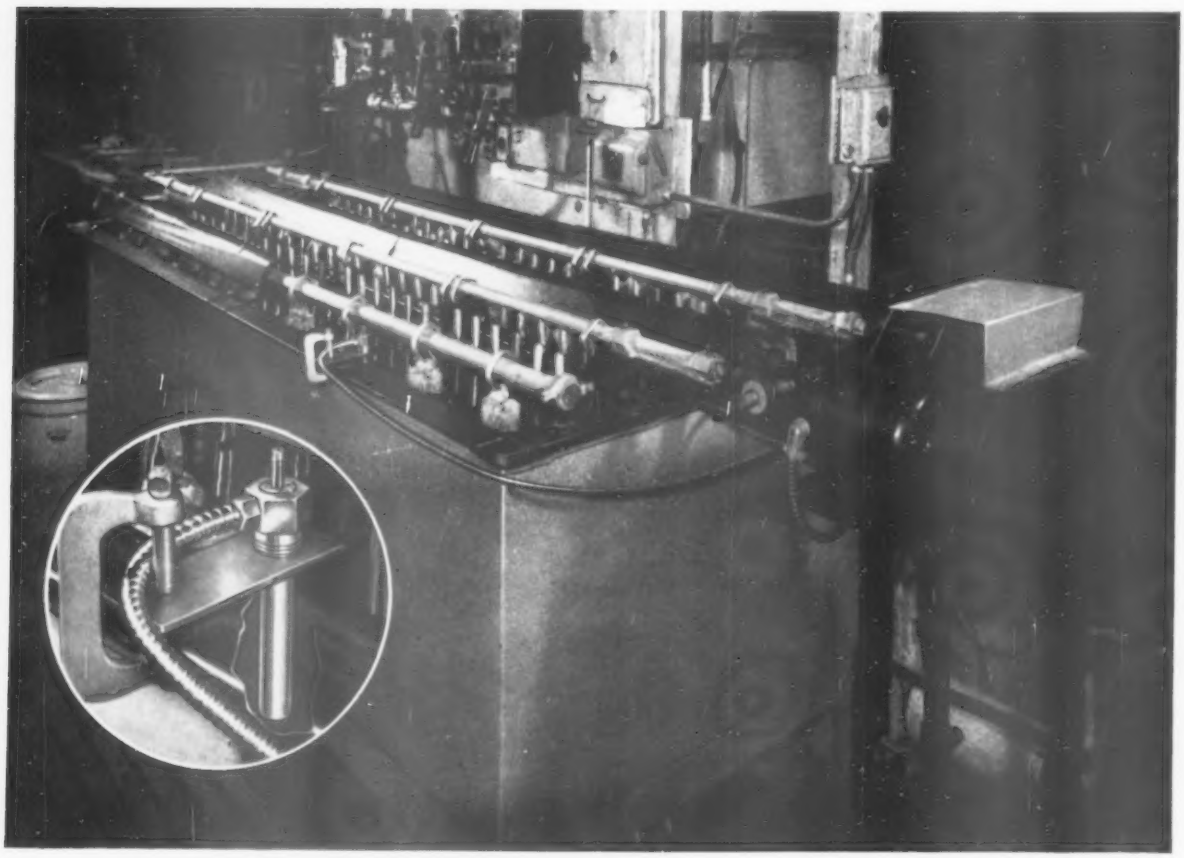
Here a Series 17100 THERMOSWITCH unit is used, with electrical leads protected by flexible conduit cable. Other available designs include cartridge, flange head, coupling head and junction box. Dial and knob can be added to most types.



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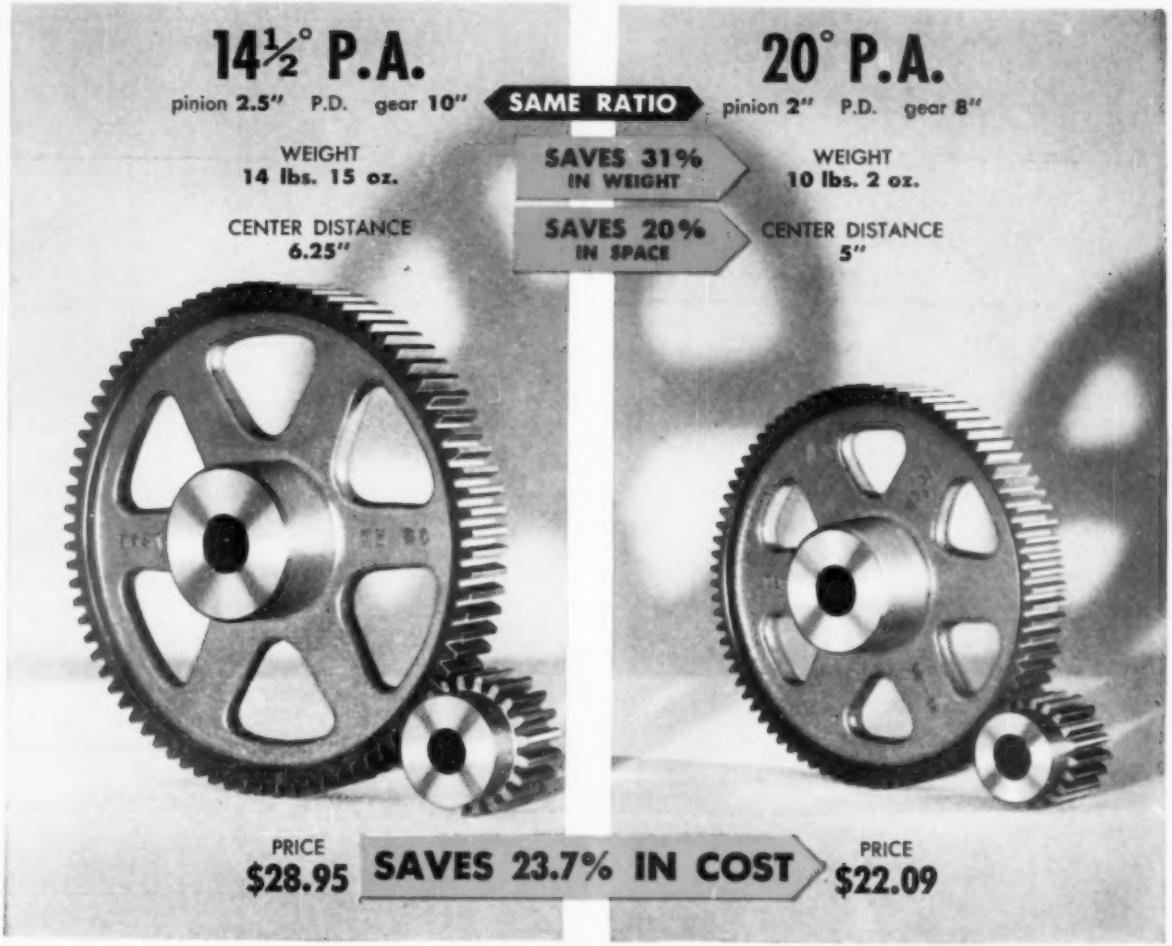

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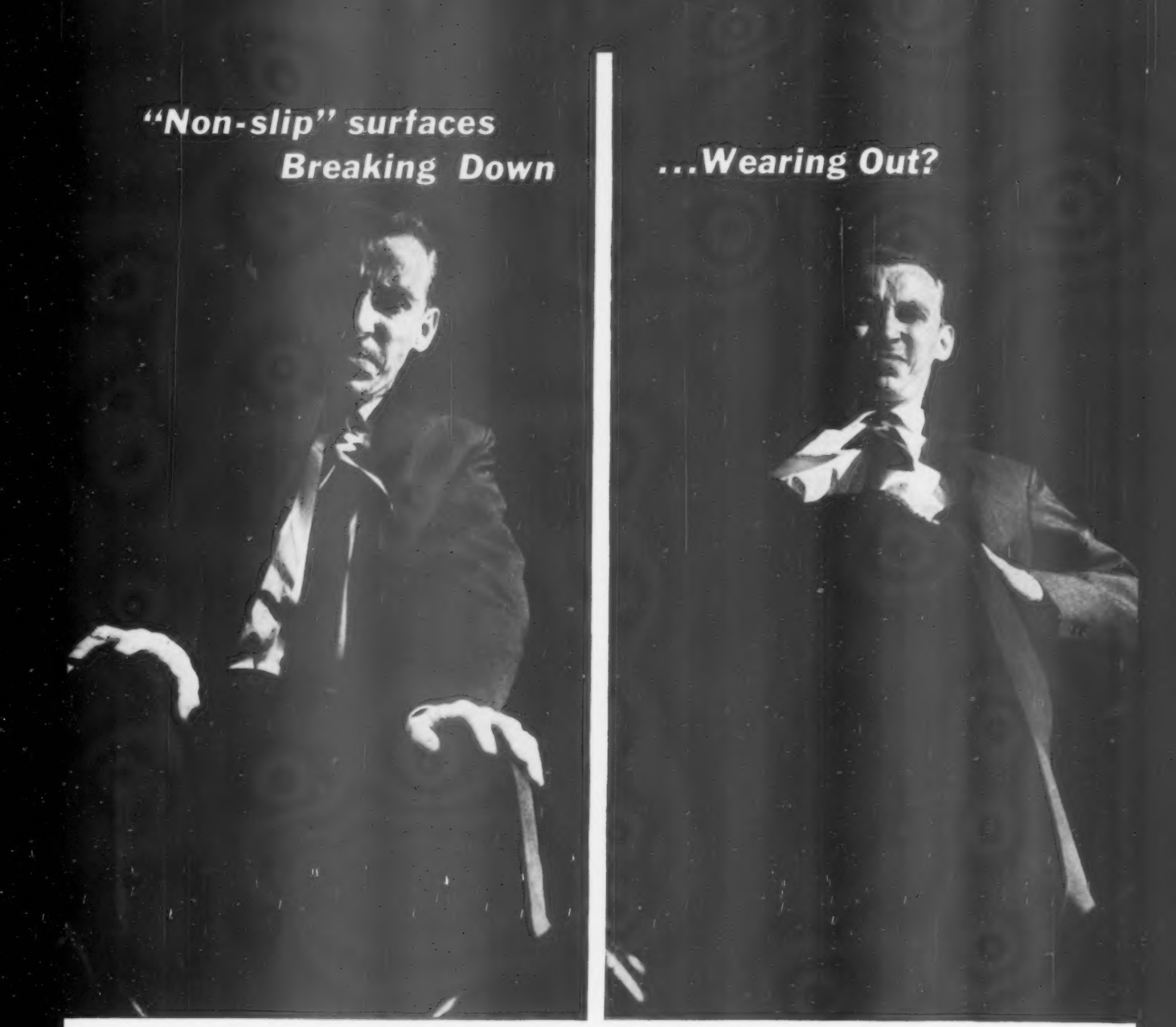

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Your choice of colors in black, gray, yellow or red. Fill in coupon for price and delivery information and your copy of new technical bulletin on M-S-A Dura-Grip. No obligation, ever. Mine Safety Appliances Company, Pittsburgh 8, Pennsylvania.

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Every day—in many ways—MSA products safeguard millions of lives

DURA-GRIP...IT STAYS DOWN

Edges, sides, and corners of tiny grit particles, impregnated in the resin bonding coat, protrude enough to form an absolutely slip-proof surface. Second locking coat permanentizes the grits. This is the Dura-Grip sandwich.

For more facts Circle 551 on Reader Service Card

Mine Safety Appliances Company
Safety Surfacing Department
Pittsburgh 8, Pennsylvania

Yes, I'm interested in more permanent underfoot safety. Please send me fact-filled data sheet, price and delivery information on new M-S-A Dura-Grip.

NAME _____ TITLE _____

FIRM _____

CITY _____ ZONE ____ STATE _____

FACTORY

IDEAS OF THE MONTH

By LEWIS K. URQUHART, Consulting Editor

(For more information, circle item numbers on Reader Service Card next to back cover)

Looking for ideas that will help make your driver-training program a howling success? You'll find six lessons all set up for your use in new 20-page instructors' manual (*Automatic Transportation*). Cartoon feature: Accidents—how they happen and how to prevent them. **(291)**

Best way we know to fight athlete's foot is with new foot-sprayer (*Onox*). Soon as bather steps on treadle, four jets douse feet and toes. Maker says sprayer uses half as much solution as sponge rubber mat. **(292)**

New safety glasses (*Bausch & Lomb*) have expansion-type end-pieces, so same frame can be used with or without side shields. Shields (six types to choose from) can be put on—or taken off—in a jiffy. **(293)**

Glass-fiber box truck (*Nutting*) is lighter than aluminum, yet practically indestructible. Steam, water, oil, mild acids and alkalies won't hurt it. Can take −40 F. cold or +212 F. heat. Two channel-steel members provide firm caster attachment as well as reinforcement against shock loads. **(294)**

And a glass-fiber skylight (*Consolidated*) with built-in squirrel-cage blower provides both ventilation and natural lighting. Leakproof, shatterproof. Five colors. Fast, one-piece installation. No ductwork. **(295)**

Booklet of the Month is "Who's Who in CO_2" (*A. O. Smith*), wherein movie, stage, and TV star John Carradine breezes through story of automatic and semi-automatic CO_2-shielded welding. **(296)**

Porta-Press is a 15-lb. punchpress (*Modern*) designed to punch out round, square, rectangular—or any shape—holes by merely changing punch and die. Can be used on stainless, brass, plastic, etc. **(297)**

Whereas Port-A-Blast is a low-priced portable sandblaster (*Precision Equipment*) that looks to us like a tool any shop would like to own. **(298)**

If high cost has cooled your ardor for closed-circuit TV, you'll be glad to learn that a new camera (*Sylvania*) is supposed to be priced well below other units currently on the market. And it weighs only 15 lb. **(299)**

Knock the W off wrench and you get a new pipe-working tool (*Nye*) that cuts hand adjusting to irreducible minimum. Rench's upper jaw is stationary. Lower jaw is free to "float" to and fro. When Rench is applied to pipe, floating jaw takes a holt and increases bite as pressure is added. **(300)**

3-D layout addicts are sure to drool over those nifty little lift trucks (*Yale*). They're cast in metal and plastic to ¼-in. scale. And the price is right. Also available: templates for 2-D work. Both mighty helpful supplements to justly famous "How Book" of cost-cutting material handling. **(301)**

Office machines stop rockin' and rollin' the minute you mount them on telescoping caster cups (*Consolidated Kinetics*). Cups are filled with high-density Fiberglas materials that damp out noise, shock, vibration. **(302)**

Pie in the sky? Nope, a doughnut. That's what Aquatore looks like. It's the newest in water-storage tanks (*Graver*). Single central supporting column. No hard-to-paint protrusions. New-plant builders, take notice. **(303)**

Twirl the dial of Fact Finder (*Scott Paper*) to determine average time it takes to clean and service your washrooms—mop floors, clean partitions, replace roll tissue, fill soap dispensers, etc. Or flip Fact Finder over to see how long it should take to fill various types of towel cabinets. **(304)**

The things that can happen to office toilers! For a real eye-opener, see a hilarious little booklet (*National Safety Council*) that hits hard at the often ridiculous causes of "Accidents in the Office." **(305)**

Pencil fanciers will go for Mars-Omnichrom (*Staedtler*), an all-purpose marker that writes thick, thin, big, or small. Seven colors. **(306)**

Mighty Mite is a small stud driver (*Remington*) that shoots fasteners into concrete or steel as fast as one a minute. Power load resembles .22 blank cartridge. A light hammer tap does the trick. **(307)**

And add Drive Straps (*Holub*) to list of fasteners. Swell for hanging conduit, pipe, BX, etc. Straps drive like nails—into wood or masonry. **(308)**

Small plants with paging systems can have music for the taking—simply by hooking up a low-priced tuner (*Granco*) that does a right nice job of picking up and transmitting FM broadcasts. **(309)**

Itching to tell your company story? One good way is the cartoon-type booklet. For a good model to follow, see "Better Things Begin Today at Allis-Chalmers." And enjoy this fact-packed story of a great company. **(310)**

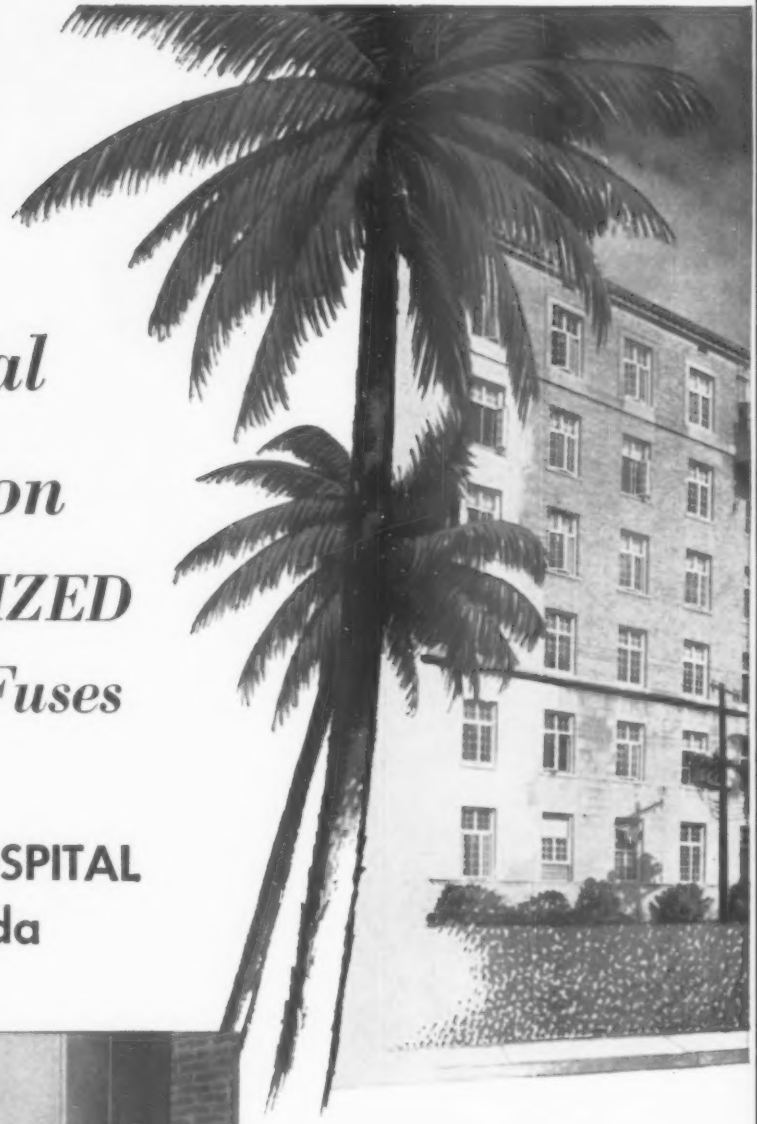
More Ideas of the Month in Press Time Report following page 90

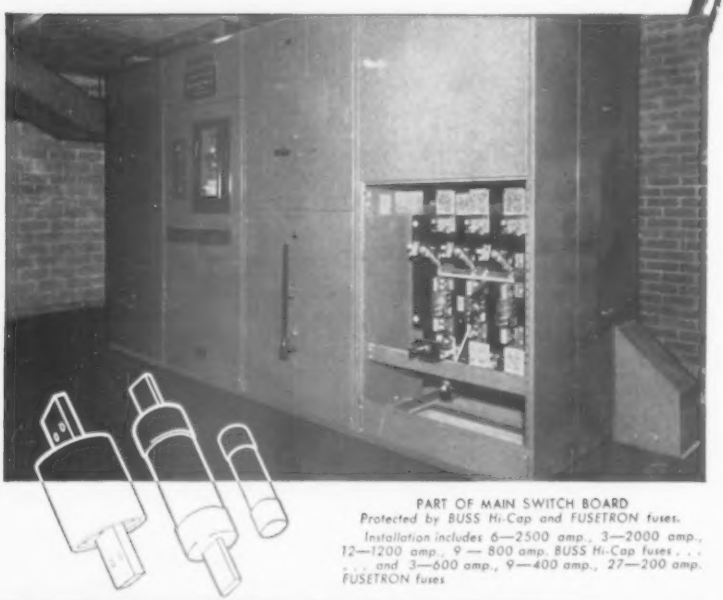
Electrical Protection

is MODERNIZED with BUSS Fuses

in the

TAMPA CITY HOSPITAL
Tampa, Florida





PART OF MAIN SWITCH BOARD
Protected by BUSS Hi-Cap and FUSETRON fuses.
Installation includes 6—2500 amp., 3—2000 amp., 12—1200 amp., 9 — 800 amp. BUSS Hi-Cap fuses . . . and 3—600 amp., 9—400 amp., 27—200 amp. FUSETRON fuses

In this beautiful hospital, tremendous in size, it was found necessary to increase the capacity of the electrical system to meet today's requirements. Modernization of the electrical system resulted in estimated available fault currents of 150,000 amperes.

With faults of this magnitude possible, it became essential that a superior type of protective device be used.

So in the main switch board are BUSS Hi-Cap fuses and FUSETRON dual-element fuses, both applied to give the interrupting capacity and dependability needed on the circuits they protect.

ANOTHER BUSS HI-CAP AND FUSETRON FUSE INSTALLATION

ARCHITECTS AND ENGINEERS: *Norman F. Six and Elliot C. Fletcher, Tampa and Schmidt, Garden and Erikson, Chicago*

CONTRACTOR: *Miller Electric Co., Jacksonville, Fla.*

WHY HIGH INTERRUPTING CAPACITY IS NEEDED

Fault currents of 75,000 or 150,000 amperes were unheard of a few years ago, — but today they are quite possible. With the generating capacity of utilities increasing yearly, most likely the magnitude of fault currents will be higher in future years.

BUSS Hi-Cap and FUSETRON dual-element fuses have an interrupting capacity designed for today's conditions and to anticipate system growth.

The interrupting rating of BUSS Hi-Cap fuses is 200,000 amperes rms symmetrical — and for FUSETRON fuses it is 100,000 rms symmetrical.

WHY DEPENDABILITY IS NEEDED

With higher fault currents available, the dependability of the protective device becomes of increasing importance.

The protective device should be just as accurate in 10, 15, or 20 years, as it is on the day installed.

A fuse is the only type of protective device to offer this advantage. A fuse must remain safe and accurate, as its operation depends on a simple thermal law. A fuse has no triggers, latches, pivots or contacts to stick or get out of order. Dust, fumes, corrosion or age cannot increase a fuse's capacity or lengthen its blowing time.

for more information

On FUSETRON dual-element fuses - (loads of 0 to 600 amps.) - ***write for bulletin FIS***

On BUSS Hi-Cap fuses - (loads above 600 amps.) - ***write for Bulletin HCS***

959

BUSSMANN MFG. DIVISION, McGraw-Edison Co. **ST. LOUIS 7, MO.**

By GEORGE A. HOY, JR., Industrial Management Editor, FACTORY

Training Under Fire

Stop at the next fire station you pass. Ask the first broad-suspendered guy you see his opinion. He'll tell you there's just no comparison between putting out a rubbish blaze and fighting a real fire in a residence or a plant. He'll tell you his real training started at his first fire.

There's a lesson in this for you, says Charles P. Boyle of Scott Paper Company (Chester, Pa.). Boyle told the Second Annual Industrial Mutual Aid Conference at Elizabeth, N. J.: "The answer to training realism is ingenuity." His suggestions:

- Make your rescue squads available for local civilian disasters—train wrecks, plane wrecks, explosions, fires, and floods.
- Let your employees who are members of local volunteer fire companies leave the job to fight fires. The same men—well trained—may save your plant.
- Train crews in gas-dispersion duties by filling an old shed with tear gas, dimming the lights, making a realistic setting for experience.
- Get local wreckers to let your disaster crews practice on doomed buildings. They can cut through floors, snip electric lines, practice rescues.
- Do as one company in Maryland does—get condemned buildings for burning. You can have the advantages of 10 to 15 good training fires this way.

Java on the Job

That famous American institution, the coffee break, is more widespread than ever, says the Pan American Coffee Bureau. And the number of workers in plants and offices who take the jitter juice twice during the day is up 17% since 1956.

Fewer plant workers, however, actually leave their jobs for java. Two years ago, 14% went out to nearby eating places at break time. Today, the restaurant sippers have dwindled to 5%.

Brass Tacks Nail Costs

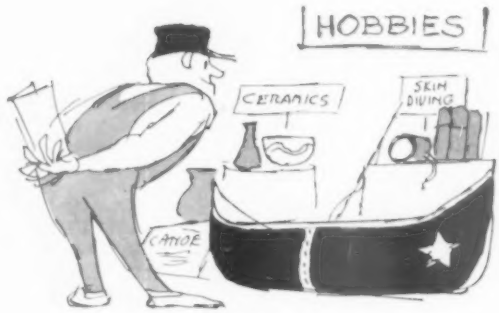
"Foremen pay little attention to the urge to cut costs," said work simplification authority Sig Fecht, in a recent visit to FACTORY's offices. "That is, unless you get down to brass tacks these three ways:

"1. Point out where the significant controllable costs occur (such as materials, indirect labor, or operating supplies).

"2. Furnish evidence of the need for cutting costs (such as orders lost, competitors' prices, dangerously low profits).

"3. Demonstrate how specific costs can be cut right in the plant—with methods the foreman can readily understand."

"Foremen," Sig comments, "are just like other people. They don't respond to generalities. You have to get specific."



Fun Exhibits at Work

Employee Irving Trimbel of the Bureau of Reclamation (Sacramento, Calif.) is a proud man. All the other employees there have seen the folding boat he designed himself. And his original fishing lures have been on display, too. Some of his fellow employees have even asked him for help on duplicating his feats of recreational creativity. And he isn't the only gratified Bureau employee.

Exhibits of craftsmanship and hobbies are a regular thing at the Bureau. Employees have exhibited skin-diving, wood-carving, painting, doll-making, cake-baking—and the more usual painting, ceramics, and photography hobbies.

These employee exhibits are placed in a heavily trafficked area. The cost to the Bureau has been negligible. And the results have been spectacular—in interest, enthusiasm, and inspiration to other employees to follow suit.

Trouble, Trouble

If you're living, you've got problems. You're tense. You're harassed by psychological stresses and strains. It's a fact of modern life, according to Dr. William C. Menninger of the famous Menninger Foundation (Topeka, Kan.).

Some of the tensions are internal, unconscious, hidden even from ourselves. Others are external—have to do with our environment. We can share these external tensions with others. In fact, learning to live and share with others is one of the best ways to reduce tension and make changes for the better in our environment.

Says Menninger: "To modify the environment, just as to modify our own selves, takes action. It means doing at least three specific things:

"1. Examine and evaluate and talk about the possible causes of tensions. It has often been said that a clear understanding of a problem is 90% of its solution. This is a proven fact in resolving conflicts within the individual personality, and this can apply also in a family, company, neighborhood, city, state, or nation.

"2. Assume full responsibility as a person, as a member of a family, as a worker on the job, as a participating citizen. This means acquiring basic education, training, and experience—continually working for better solutions of the problems of the groups in which we find ourselves.

"3. Plan for the future with care. Such planning has economic, social, educational, and vocational aspects. Important in this is to discover the job that's best suited to one's abilities and opportunities; then relieve the routine and responsibility of the job with an avocation or hobby. Often recreation can serve for re-creation."

What Workers Want

The differences between supervisors and their men aren't as large as supervisors think, concludes University of Michigan Social Researcher Robert L. Kahn. First-line supervisors commonly make the mistake of overestimating the importance of high wages to their men. And they tend to underestimate their workers' strong desire for good interpersonal relations on the job. Also much the same pattern prevails between first-line foremen and general foremen, says Kahn.

In reality, foremen and their workers want much the same things from their jobs.

They want steady work and steady wages. They want to get along well with others on the job. And they want high wages, chances for promotion, opportunities to do interesting work, and good physical working conditions.

Since the supervisor can't raise pay, security, or opportunity every day, Kahn suggests these ways of meeting employee needs:

- Support. Most workers need to be approved and accepted by people in authority over them. Supervisors meet real needs when they behave in a warm, supportive fashion toward their men.
- Help in meeting job goals. The supervisor who improves work planning or eliminates production bottlenecks helps workers achieve their goals.
- Defining the way to advance. Workers need to know the factors that lead the supervisor to recommend advancement for a man—be it favoritism, special training, performance on the job, or some other set of factors. And men aren't fooled for long when a supervisor doesn't follow the criteria he claims are important.
- Helping set personal goals. Many workers have their goals in life well formed when they first arrive on the scene. Others, like the worker who had never thought of promotion and is encouraged to work toward it, can have their personal goals heavily influenced by their supervisor.

Schooling for the Jobless

School classrooms in 14 states are busy long after the regular students have gone home. They're used to retrain older workers who have been displaced by age or automation.

The survey of adult education was made by the U. S. Department of Health, Education and Welfare. The 14 states retraining older workers are Arkansas, Georgia, Idaho, Indiana, Iowa, Kentucky, Maine, Nevada, New Hampshire, New Jersey, New York, Oklahoma, Virginia, and West Virginia. In three of these states, trade and technical instruction account for 23% of all adult education.

The survey shows a marked trend toward making adult instruction an integral part of the school program. States that have granted aid to local school districts for such education have six times as many adults enrolled as non-contributing states.

R-1051
Static Pressure
Indicator-Controller

T-800
Remote Bulb
Thermostat

V-210
Three-Way
By-Pass Valve

V-108
Three-Way
Mixing Valve

T-1000
Recorder-
Controller

T-400
Room Thermostat

V-530
Precision Pilot
Positioner
applied to valve

D-225
Louver Damper

V-153
Sylphon
Diaphragm Valve

D-251
Piston Damper
Operator

Vitro Laboratories, Silver Spring, Maryland, Division of Vitro Corporation of America. Leon S. Barton, architect, New York, N. Y.; Vitro Engineering Company, mechanical engineers, New York, N. Y.; Victor R. Beauchamp, Inc., general contractor, Washington, D. C.; Harry E. Nau Co., Inc., mechanical contractor, Washington, D. C.

JOHNSON CONTROL assures ideal working climate at Vitro Laboratories

A creative group of some 450 technical personnel occupies the spacious new building of Vitro Laboratories in Silver Spring, Maryland. This outstanding facility is devoted chiefly to physical research and development in ordnance and related fields, including rocket propulsion, guided missile systems, torpedoes, directors, computers, mines, fire control, underwater acoustics, countermeasures, and special weapons.

As so many progressive industrial organizations are doing, Vitro provides its people with the best possible physical environment for this vital work. The building is completely air conditioned and equipped with a Johnson Pneumatic Temperature Control System that assures ideal thermal conditions at all times.

Such an environment makes important contributions to working efficiency, helps attract and hold good employees, and reduces absenteeism and costly turnover to a minimum.

Proper control of industrial air conditioning, heating, and ventilating systems is becoming increasingly important as a means of cutting costs and increasing profits. Whether your particular problems involve comfort control or provision of protective temperatures and humidities for products and processes, the specialized Johnson organization can install a control system to meet your exact requirements.

When you build or air condition, have a nearby Johnson engineer demonstrate the unmatched advantages of a Johnson Pneumatic System. There is no obligation. Johnson Service Company, Milwaukee 1, Wisconsin.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

Johnson makes the most complete line of pneumatic control equipment for solving any problem of temperature, humidity, and pressure control. Equipment includes thermostats, recorder-controllers, valves, dampers, damper operators, pressure regulators, humidostats, humidifiers, thermometers, switches, special controllers, and a complete line of pneumatic transmission and control center instruments.

Get the "PLUS" values of pneumatic controls by Johnson

Widest Application. Johnson Controls are applied to all types of air-conditioning, heating, and ventilating equipment, and can meet any comfort or process requirement. Each system is engineered to meet the specific needs of the individual plant.

Greater Simplicity. Pneumatic control involves far fewer and much simpler components than anything else you can use. There are fewer components to check, fewer parts subject to failure.

Lowest Lifetime Cost. The combined cost of installing, operating, and maintaining a pneumatic control system over the life of the building is substantially below that of any other type of control system.

Reliable Performance. Johnson Pneumatic Controls are unaffected by short circuits, electrical overloads, voltage variations, and humidity. You get continuously accurate control.

Complete Safety . . . even in the presence of explosive gases, solvents, dusts, and other hazardous materials.

Dependable Service. Johnson maintains the oldest and largest service organization in its field. Full-time, factory-trained servicemen are on duty in 105 direct branch offices and over 200 other cities.

For more facts Circle 553 on Reader Service Card

Your Guide to Action on Problems

If your employee attitude survey reveals these problems... / ...here's the action you should take	ATTITUDE TOWARD JOB										ATTITUDE TOWARD BOSS									
	1. Poor air	2. Inadequate lighting	3. Congestion	4. Sloppy housekeeping	5. Lack of friendliness	6. Poor job placement	7. Poor use of skills	8. Bad work schedule	9. Delays in work	10. Hazardous work	11. Boss not qualified	12. Boss not fair	13. Arbitrary discipline	14. Poor planning by boss	15. Inadequate explanations	16. Boss not helpful	17. No participation	18. Poor suggestion handling	19. Poor complaints handling	20. Boss fails to praise
Interview key employees											X									
Interview groups of workers			X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X
Call in insurance specialists										X										
Use medical, sanitation experts				X						X										
Hire management consultant			X		X			X	X	X	X									
Utilize appropriate specialists	X	X																		
Appoint committee, assign task	X	X	X	X				X	X	X										
Recognize employees					X	X					X	X					X			X
Use psychological tests						X	X													
Search for talent in ranks						X	X													
Publish results of survey																				
Clarify written communication																				
Give information to employees						X									X					
Publicize internal promotions							X													
Issue policy statements							X													
Open channels of communication																				
Train executives													X	X	X		X	X	X	X
Train supervisors											X	X	X	X	X	X	X	X	X	X
Train employees in the job																				
Train employees for advancement							X													
Study relations between groups					X			X												
Analyze the grapevine					X															
Identify the natural leaders					X												X			
Improve community relations																				

How to Follow Through After

Real test of a survey's worth (and only reason for making it) is your follow-through. Here's your guide to action after you find what your employees think.

THE SURVEY of attitudes at the furniture company was finished. One problem was clear: Employees were dissatisfied with their supervisor's ability to plan the work.

Plant management felt the problem was serious enough to merit action. But what action? Should a supervisory training program on planning be set up? Should supervisors have more direction and training from up the line? Should production planning be reorganized?

Fortunately for this company, none of these things was done. Confidential interviews with the supervisors themselves revealed that the real problem wasn't in production at all. The sales department was the culprit. Salesmen were accepting custom specifications for standard items of furniture. Planning in the shop was suffering because supervisors constantly had to interrupt production runs to meet special dimensions and finishes. Armed with

By EUGENE J. BENGE
Management Consultant
Asheville, N. C.

Revealed in Your Employee Attitudes Survey

	ATTITUDE TOWARD COMPANY										WAGE COMPARISONS				FRINGE BENEFITS							COMPANY MANAGEMENT			
	21. Few opportunities offered	22. Vacancies improperly filled	23. Poor personnel department	24. Job security poor	25. Too much automation	26. A poor employer	27. Poor community reputation	28. Poor industry reputation	29. Poor national reputation	30. Unimportant in community	31. Low within department	32. Low within company	33. Low within industry	34. Too low for living costs	35. Vacation policy outmoded	36. Poor sickness policy	37. Inadequate hospitalization	38. Inadequate death benefits	39. Inadequate pensions	40. Inadequate medical aid	41. Poor lunch facilities	42. Doesn't understand workers	43. Doesn't inform workers	44. Uses weak information media	45. Ignores community
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Your Employee Attitude Survey

these facts, management took action to solve the problem.

This furniture company's case is unusual for two reasons:

• **Because the company took action.** It's much more common for managers to feel their objective has been reached once the survey results are tabulated and bound in a folder.

• **Because the action taken was the right action.** Many managers would have taken action based on the survey results alone. But such action taken at the furniture company would have been wrong.

What's needed after an attitude survey is a systematic way of getting to the root of the real problems suggested by the survey. The chart above will give you the directed action you need. Here's how it works:

For every problem (vertical list) your survey results identify, there are one or more corrective steps (horizontal list) to help solve it. This chart is a checklist to make sure you've examined every possible corrective action for your morale headaches. Because it's only too true that you can't always cure the headache with the medicine that' closest on the shelf.

Go back to the furniture company. Its problem was No. 14 (chart), Attitude Toward Boss—Planning. Employees felt the planning was bad. The logical solution was training for the supervisors—either in a program, or individually through their superintendent's close supervision. But the chart suggests two other avenues of approach: (1) interviews with anonymous groups and (2) training for executives.

Turn the page

The interviews helped pin down the real problem. The executive group was called in to learn about the problem, help solve it. By following the rule and checking out every device before taking action, the company avoided any mistake.

HOW TO ACT ON FINDINGS

The corrective actions (chart on pages 192-93, left column) are easy to write down but hard to effect. They are general. What you need is specific action. So here are some specific actions—and some real-life case studies. They should help you get a better grasp of what to do after the survey results are in.

Interviewing—When the survey shows low morale in departments or shifts, as well as specific topics that worry employees, you'll want to interview representative people from the department or shift.

Tell them that you don't want their names. That you're seeking reasons behind certain low responses from their group. That you'll want them to approve the notes you're preparing for top management. Usually one courageous employee will break the ice. Once that happens you'll get a deluge of reports. Typical: The night shift foreman often comes in drunk. A pet employee mows the lawn for the foreman. The superintendent is using company employees on company time to help build his new house. Spoiled work is surreptitiously sent to salvage so it won't lower the group bonus.

Employees have an innate sense of fairness on matters of this kind, yet usually won't tattle to superiors. Their resentment shows up in lowered morale. But they welcome the opportunity of telling about conditions that are wrong—if they're not put in the position of tale-bearing or currying favor.

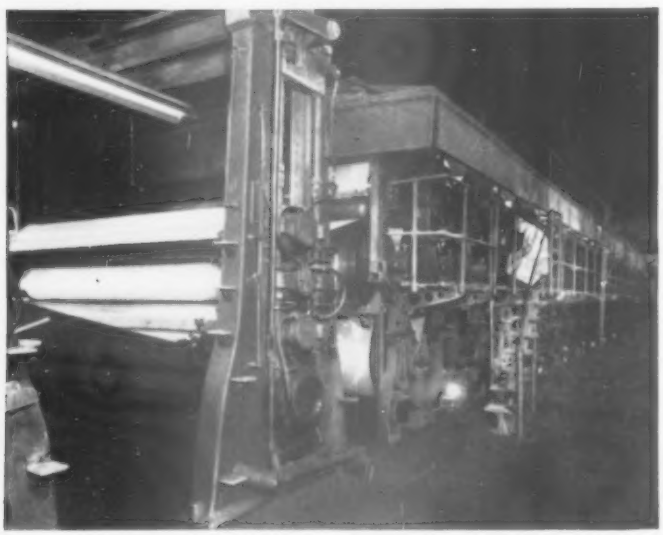
• *Case in point.* A gripe came to light as a write-in. Some employees had milk delivered each morning. By noon it was lukewarm, sometimes had soured. The shop foreman had stopped the practice of putting bottles in the cooling chamber of a drinking fountain.

Investigation showed the foreman's decision had been right. But the employees were invited to build a small box from discarded stainless steel and run the waste water from the fountain through coils in the box. The problem was solved.

Using advice of specialists—Many survey results clearly suggest the need for professional advice. For example, you may need an insurance company inspector to look for accident hazards. Or you may ask the company doctor to review first-aid facilities. Or invite an industrial medical consultant to survey your medical service. Or ask an outside industrial engineer to study work delays, time standards, and incentive pay. Or bring in a management consultant for studies of organization,

Quick case history—reading time 58 seconds

How Hagafilm® stopped pipe corrosion, reduced daily fuel costs at WHIPPANY PAPER BOARD COMPANY



THE PLANT: One of the nation's largest producers of paper board and cardboard, Whippany Paper Board Company's Clifton, New Jersey plant uses secondary steam to progressively reduce moisture content in their products during manufacture. Steam is used to heat the more than 20 rolls in each paper machine to effect this drying.

THE PROBLEM: High corrosive action of the steam necessitated replacement of 18-20 pipe nipples *every three weeks*, raised maintenance costs. Corrosion deposits in pipes impeded heat transfer effectiveness, increased fuel costs. Steam traps frequently clogged.

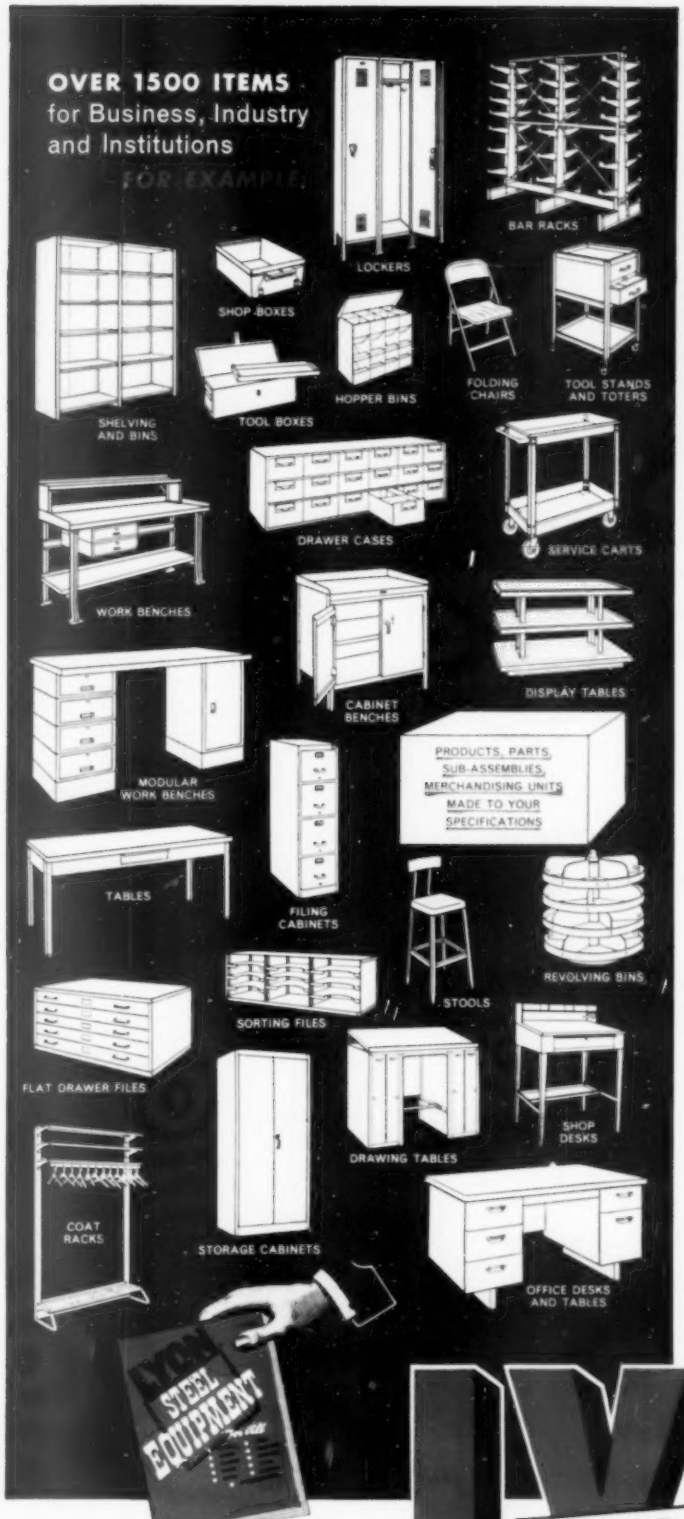
THE SOLUTION: Hagafilm. Since introduction of Hagafilm into boiler feedwater system three years ago, no pipe nipples have needed to be replaced due to corrosion. Because Hagafilm treatment cleaned out old corrosion deposits, the surface temperature of the dryer rolls increased about 20°F. Steam trap clogging no longer fouls up plant operation.

TEST RESULTS: Hall Laboratories engineers, testing the system, had to wait five months before testing strips showed enough corrosion to even be measured. After five months, the strip located at the turbo-generator outlet showed the extremely low corrosion rate of 0.4 mg/dm²/day (.00007 IPY). The strip at the steam trap discharge had an equally low corrosion rate of 1.4 mg/dm²/day (.00025 IPY).

FOR FULL INFORMATION on how Hagafilm can help in your plant operation by putting a thin protective film of metal surfaces throughout the condensate system, contact Hagan Chemicals & Controls, Inc.

HAGAN CHEMICALS & CONTROLS, INC.
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

For more facts Circle 554 on Reader Service Card



THIS CATALOG ILLUSTRATES
THE WORLD'S MOST
DIVERSIFIED LINE
OF STEEL EQUIPMENT
IT'S FREE!

★QP

★QUALITY PROTECTED BY LYON "POINT-CHECK" SYSTEM

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✓ FINISHING | ✓ PACKAGING

Look for the "QP" on every Lyon Carton. It is your assurance of quality equipment.

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LYON METAL PRODUCTS, INC.
General Offices: 912 Monroe Ave., Aurora, Illinois
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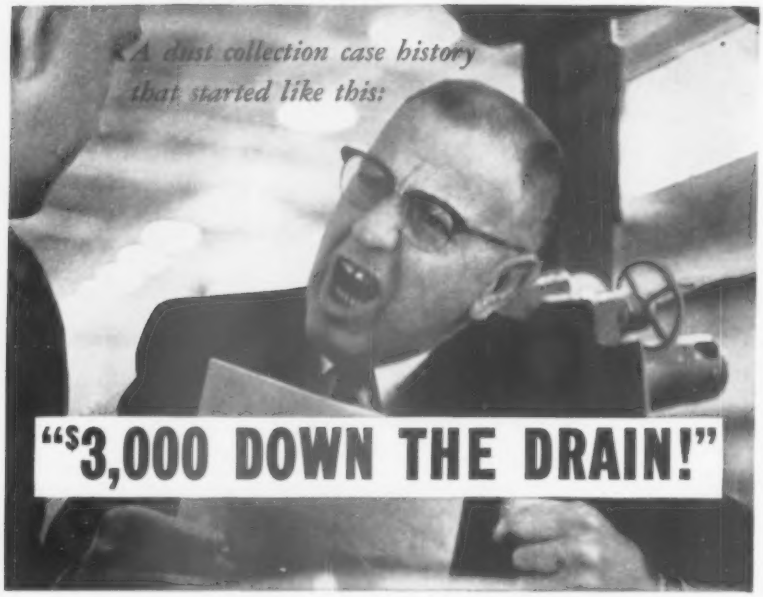
LYON®
STEEL EQUIPMENT



"Get rid of that DUST!"

"The boss was sore and I was on the spot.

"He shoved the report from the efficiency engineer at me. I read it: 'Yearly loss due to machine wear, misalignment and down time . . . $3,000. Major cause . . . abrasive dust.'

"The boss pointed his finger at me, 'Get rid of that dust and get rid of it fast!' "

Now, it was my problem, and I was on the spot.

"First thing I did was to check into a central dust collecting system. But the lowest bid I could get was $8,000. Too much.

"Then I came across a Torit ad, offering economical portable dust collectors.

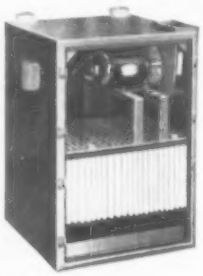
"Two days after my call Torit engineers showed me how in only one week they could install a portable, unitized Torit Dust Collector at each of our eight grinders, trapping dust right at its source—cleaning the air throughout the entire plant.

"Total cost? Only $2400.00. That's a $5,600.00 saving over the lowest priced central system.

"You guessed it—we installed the eight Torit Collectors."

Torit solved my problem

"This year when we received our report it read: 'Loss due to machine wear, misalignment and down time...$340.00.' A saving of $2,660.



"This time the boss was all smiles. He slapped me on the back, 'Charlie, you did a fine job getting rid of that dust. Frankly, I didn't think it could be done with such a small investment.'

"Now there's a pretty nice fellow to work for.

"If you've got a dust problem, or are about to have one, write the Torit people. They've manufactured and sold more dust collectors than anyone else in the U.S.A. Chances are they can help you the way they helped us."

TORIT manufacturing company

1133 Rankin Street, St. Paul 16, Minn., Dept. 311

SURVEY FOLLOW-UP

Begins on page 192

authorities, and responsibilities. Or have a food expert review the cafeteria operation.

Bringing employees in—One sure-fire way to improve morale is through greater participation. But it has to be on the right problem. For example, you might appoint small committees on lighting, atmosphere, cafeteria, or shift change. A typical committee would consist of the foreman, a key employee or shop steward, the personnel manager.

But you can't solve all problems in committee. Sometimes all you can do is get employees to understand the complexity of the problems. Committees investigating a problem may report they can't find a solution—and they soon convince fellow employees that nothing can be done. Here are five typical problems to which you just can't expect small committees to find answers:

1. Employee racial tensions.
2. Drafts on a shipping platform.
3. High cost of air conditioning an entire plant. (The plant was already operating at a loss.)
4. Putting all employees on incentive pay.
5. Getting customers to stop asking for minor changes in standard product specifications.

Another device that gives employees a feeling of participation is recognition. Public praise, titles, pins, awards—even a mention in the plant paper—mean a great deal.

A search-for-talent program often pays off. You can invite employees to take a series of vocational guidance tests designed to gage their abilities and interests. Of those who volunteer, about one-third will probably have talents your company needs. You can enter and cross-index their qualifications in a "talent file." Normally such individuals have already started up the promotion ladder but this search will often bring to light others with exceptional ability. Of even greater importance is the confidence employees will get. They will know there's a system at work to insure internal promotion.

• *Case in point.* A program of aptitude and interest testing in one company revealed a wealth of management material in employee ranks.

Turn to page 200

For more facts Circle 556 on Reader Service Card

For more facts Circle 557 on Reader Service Card ➤

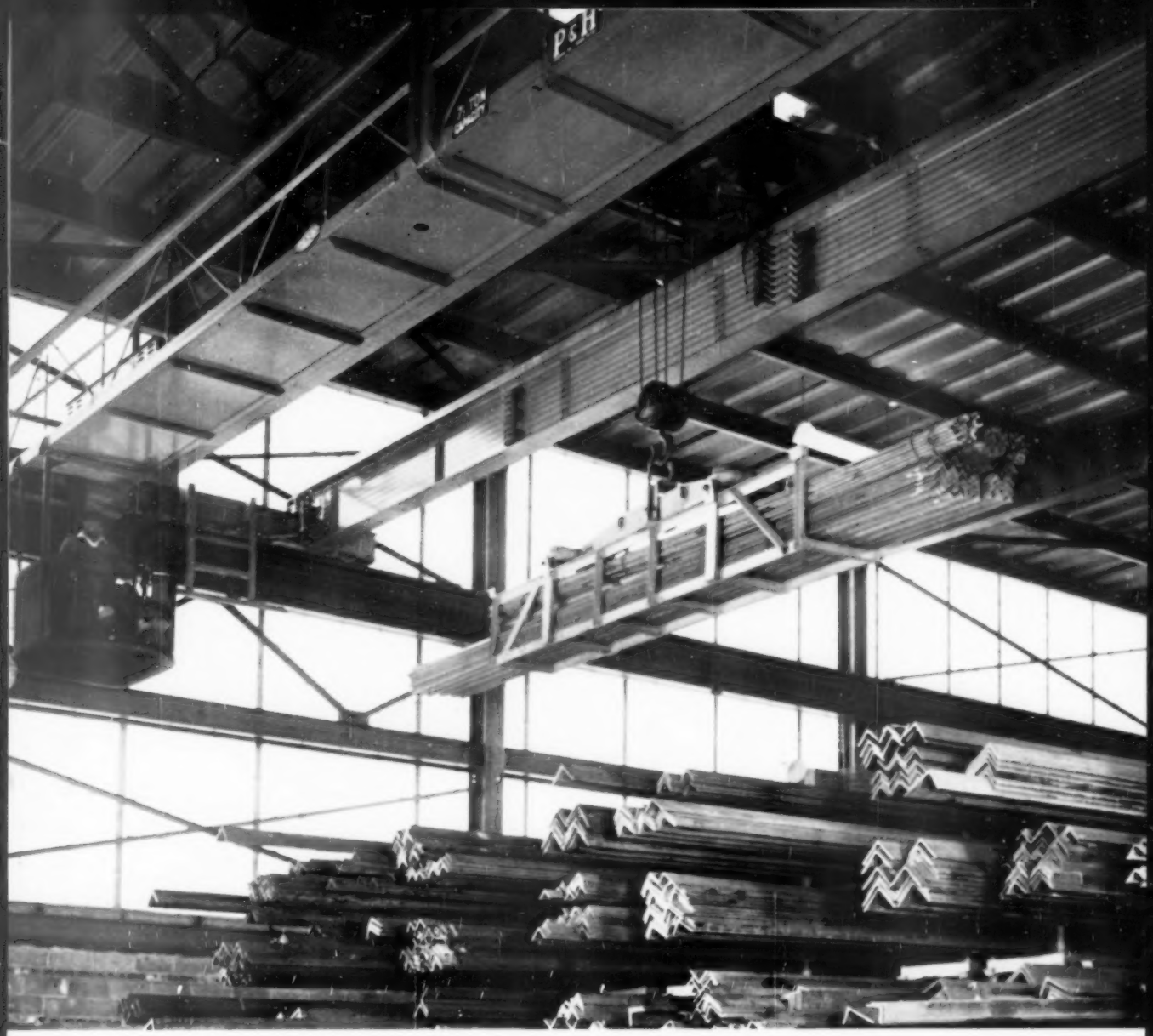


Photo Courtesy Simon Holland and Son Company, Inc., Brooklyn, N. Y.

FOR EVERY APPLICATION, THERE'S ONE CRANE OUTSTANDING...

IN METAL FABRICATION: Low-cost, 5-speed, standard-built P&H cranes provide quick, economical handling of a variety of steel shapes in this eastern fabrication shop. This 7½ ton unit has a 55 foot span, but by using I-beam construction, it furnishes fast thru-the-air steel handling with a minimum of dead weight imposed on the runway. This means that the inexpensive first cost is matched with low maintenance costs.

Built with all the care and craftsmanship found in *every* P&H crane, these units are heavyweights in performance, lightweight only in price, and are backed with the famous P&H guarantee of undivided responsibility on *all* structural, mechanical, and electrical parts. *Only* P&H gives you this assurance. Read the details in Bulletin C-51. Write for your free copy to Dept. 104, Harnischfeger Corp., Milwaukee 46, Wisconsin.

P&H

HARNISCHFEGER

...quality and service for 75 years

75

Photo Courtesy Waukesha Motor Company

...ON A DIME, GENTLY!

WHEN CLOSE SPOTTING IS THE NEED, P&H ZIP-LIFT IS THE STANDARD.

P&H Zip-Lift hoists excel in their ability to spot delicate loads on a dime, quickly — but gently. That's why you'll find Zip-Lifts aplenty . . . hanging over every vital lifting area . . . in this engine manufacturer's plant.

Why Zip-Lift?

First: Zip-Lift is *close-spotting*. Precision spotting of even awkward loads is done with the touch of a button. One hand control operation leaves other hand free to guide the load right to the spot.

Second: Zip-Lift *always works*. Its consistent dependability has been proven in tens of thousands of applications and under the toughest working conditions.

Third: Zip-Lift is *safe*. Workers are protected by a complete line of safety features including dual brakes, shrouded load block, low 24 volt control, and two limit switches that protect worker, load and hoist.

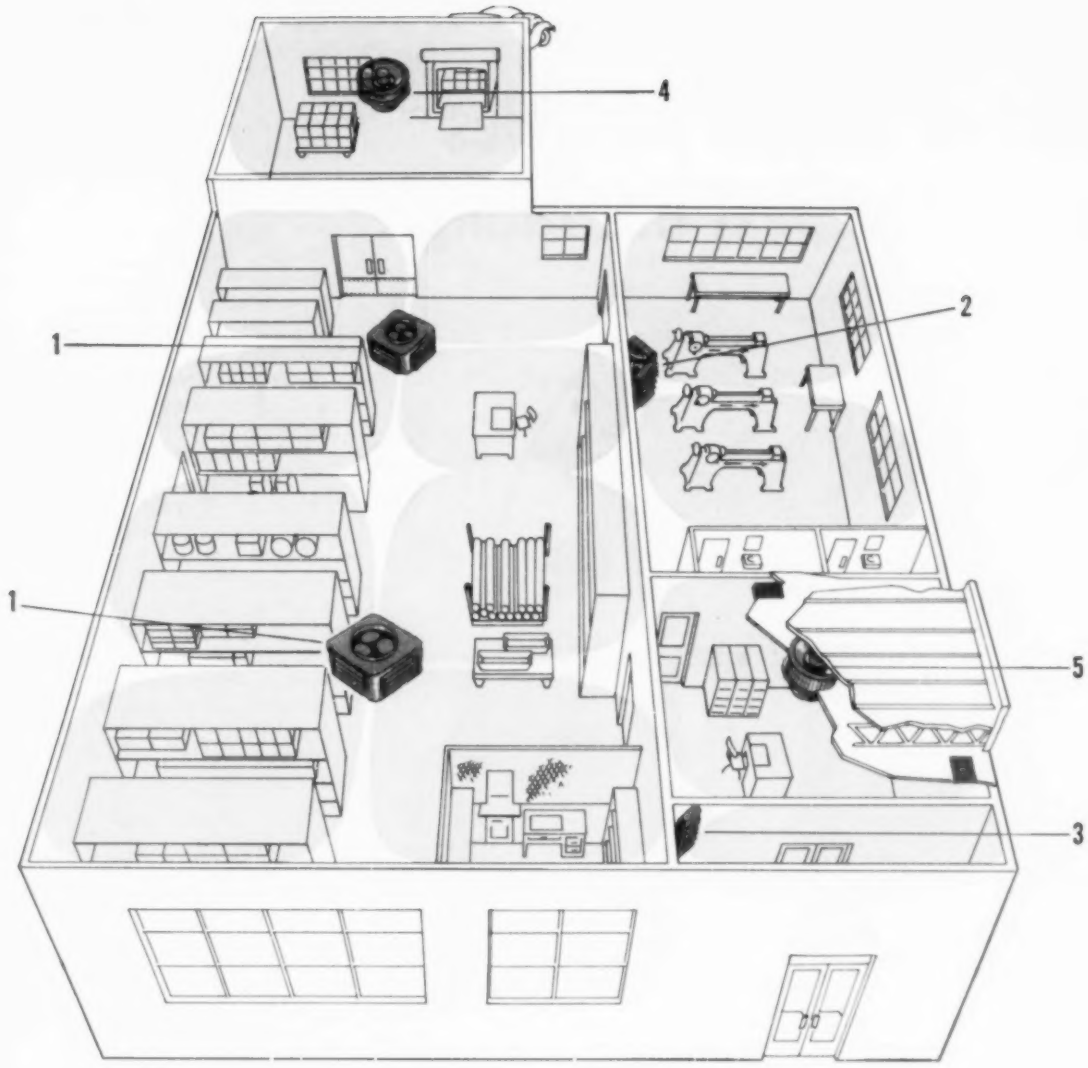
Best of all, Zip-Lift is *priced right* — at no sacrifice of quality.

The complete story on Zip-Lift is yours for the asking in Bulletin H-20. Write Dept. 204, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

75

P&H **HARNISCHFEGER**

...quality and service for 75 years



CARRIER SHAPES ITS HEAT TO FIT YOUR SPACE

—saves you money from the start

Carrier Unit Heaters distribute their heat in a designed pattern. These patterns can be made to fit any space. **Result:** you save on installation, because fewer units are needed. And you also save on operating costs. One Carrier "Clover Leaf" Heater does the work of two or more vertical discharge heaters or four to six horizontal heaters.

The building layout shows usage of all types of Carrier Unit Heaters. Two 46S 4-Way Unit Heaters use the full "Clover Leaf" discharge pattern, reach to the farthest corners of the large warehouse (see 1). The smaller machine shop area is kept warm by two 46U Horizontal Unit Heaters (see 2). Another 46U keeps the entrance comfortable (see 3). The shipping area is high ceilinged, a 46SD Vertical Unit Heater streams warm air down to the working level (see 4). A similar unit, recessed in ceiling, heats the office through diffusers (see 5).

For complete information call your Carrier Unit Heater Representative or Wholesaler listed under "Heaters—Unit" in your Yellow Pages. Or, if you prefer, write Carrier Corporation, Syracuse, New York.

Carrier air conditioning • refrigeration • heating • ventilating

New Kidde carbon dioxide portables awarded highest U.L. rating!

Belleville, N. J. — A spokesman for Walter Kidde & Company announced here today that four of the company's new portable fire extinguishers have been awarded the Underwriters' Laboratories highest ratings for their respective capacities. To those interested in fire safety, this means that, pound for pound, these new Kidde units have more fire-killing power than any other carbon dioxide extinguishers on the market today.

Available in 15 and 20 pound capacities, in either squeeze valve or trigger models, these power-packed Kidde units feature new hose and discharge horn assemblies, which are responsible for their extra fire fighting ability. The new assembly is supplied also with Kidde's 10 pound carbon dioxide portable which has a U. L. rating not exceeded by any other extinguisher of its capacity. This hose-horn combination is also being offered as a replacement unit for existing 10, 15 and 20 pound carbon dioxide units, and when attached will upgrade their effectiveness equal to the new ratings.

For more information on these top-rated Kidde carbon dioxide portables write Kidde today.

Kidde

Industrial and Marine Division
Walter Kidde & Company, Inc.
932 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal — Toronto — Vancouver

SURVEY FOLLOW-UP
Begins on page 192

Top management men were astounded. They had concluded that their employee rolls were completely without talent. Granted, employees often resist testing programs. But negative reactions are counterbalanced by good reactions when they realize management is interested in finding employees to promote from within.

Improving communication—You can start a program of improved communications by publishing a report of the employee attitude survey. Use the employee paper if you have one. And if your survey results show misunderstanding, study the clarity of written communication in the plant. Could be your language is stuffy, hard to read—sentences too long, words too complex.

Ask yourself if you give employees information about profits, security, competitive markets, products. They like it, if it's straight from the shoulder. You can give publicity to promotions—and explain why, if you bring in employees from outside. You can publish policies—policies on promoting from within, on what would happen if labor-saving machinery were installed, on transfers and seniority.

Your main job is to insure open channels for five-way communication—down and return, up and return, and laterally at supervisory levels and higher.

• *Case in point.* One company survey showed poor responses to the medical service, despite outstanding equipment and staff. Interviewing in depth told this story:

The former medical director had given treatment to employees and their families. Physicians in the community had protested. When management instructed the medical director to curtail these practices, he had resigned. The new medical director confined himself largely to examinations, referrals, and emergencies. Employees resented the loss of free medical attention. In this instance, management stood by its guns, but explained reasons for the new status to employees.

Training—It's best to show results of the attitude survey to each supervisor. One way to do the job with extra impact: Mimeograph a

For more facts Circle 559 on Reader Service Card
See LOCAL SOURCES Section This Issue
For more facts Circle 560 on Reader Service Card ➤

FIRST completely static protective relay!

...Available in Allis-Chalmers switchgear

This highly reliable *new* protective overcurrent relay has no moving parts . . . it's static, and it's only ⅓ the size of conventional relays.

Employing transistors, printed circuits, and other electronic components encased in epoxy-resin, A-C static relays are shock and moisture resistant. They're unaffected by temperature changes, operate with low burden, and have instantaneous reset feature. Quick plug-in construction makes replacement easy.

Want more protective relay-equipped switchgear facts? Contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C Introduces New Static Relay

COLLEGE STATION, Texas, April 13 — Over 300 relay engineers and scientists witnessed another example of the Electronic Age today when Allis-Chalmers introduced a new static protective relay. The new development was disclosed in an engineering paper presented by John Baude, Allis-Chalmers engineer, before the Twelfth Annual Conference for Protective Relay Engineers.

The new relay, designed ... industrial switchgear ... is the first major ... from conventional ... tion in 50 years.

PARTS

... significance ... on of all mov... ...h the use of ...ors such as ... des, thermis...

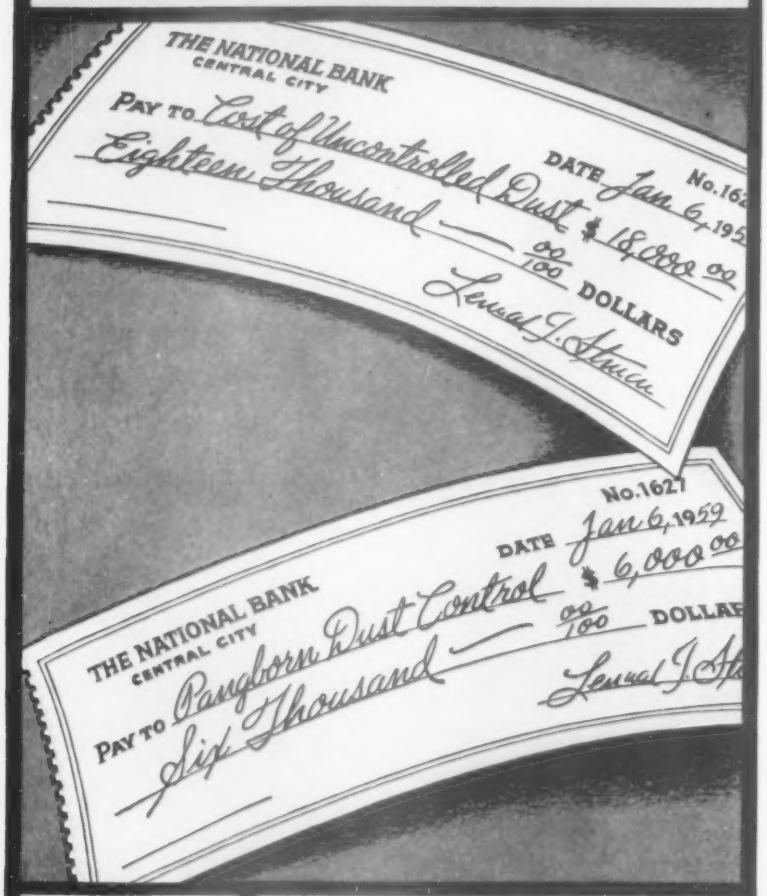
ALLIS-CHALMERS

A-1157-G1

Plan to stay ahead... MODERNIZE!

Small size saves panel space.

WHICH CHECK WOULD YOU RATHER WRITE?



How much are you paying for uncontrolled dust?

See for yourself—add up the cost of your lost salvageable material, housekeeping expenses, excess machine wear, intangibles such as community and employee goodwill. Whether your total is moderate or high, Pangborn Dust Control will cost you *less* than uncontrolled dust.

For details on Pangborn's engineering knowledge and experience, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 2100 Pangborn Blvd., Hagerstown, Maryland. *Manufacturers of Dust Control and Blast Cleaning Equipment — Rotoblast® Steel Shot and Grit.*

Pangborn CONTROLS DUST

Begins on page 192

list of all multiple-choice questions and show the average for the company. Explain the significance of these over-all figures to each supervisor—in a private conference. He'll ask about the attitudes of his own group. Read his figures to him and let him enter them on the sheet. He'll invite suggestions on how he can improve his low figures.

Another way to give practical training at any level is to compare an employee's qualifications against specifications of some higher job, thus note his deficiencies for it. You can develop answers to the four-part question: "What does he need to know, do, be, or have?" Then take steps to correct his weaknesses.

Improving group relations—If the survey shows up problems in attitude toward management or company, you could take these steps:

1. Make a special study of relations with employee groups, associations, the union, etc.
2. Analyze the informal employee organization (the grapevine).
3. Identify their natural leaders.
4. Establish a program for improving community relations.

• *Case in point.* In one company, the playboy brother of the president managed one of the plants. In answering the questionnaire employees said they liked him. But morale was low, and the cause hard to find.

Interviews with groups of employees showed that employees were subconsciously resentful of the playboy. He was often criticized in the local newspaper, came to work while slightly tipsy, spent money foolishly in the community, and in other ways had forfeited respect.

The president thought enough of these interview results to send his brother on a five-month business trip, where his playboy proclivities might be better appreciated.

15 REAL-LIFE STORIES

Following are 15 examples of problems spotted by (and solved as a result of) attitude surveys at plants throughout the country. The reports are sketchy, to save your time. But they show the kind of findings an attitude survey can unearth—and the action that can follow if man-

For more facts Circle 561 on Reader Service Card

For more facts Circle 562 on Reader Service Card ►

Allis-Chalmers introduces...

New vertical turbine pump—the prime pump that needs no priming

Now Allis-Chalmers brings its 85 years of pump experience to the short-coupled vertical turbine-type field. This addition not only rounds out industry's most complete single source for pump installations, it offers many advantages wherever liquids are to be pumped. Standard sizes for heads up to 400 ft or more, and capacities ranging from 20 to 8000 gpm.

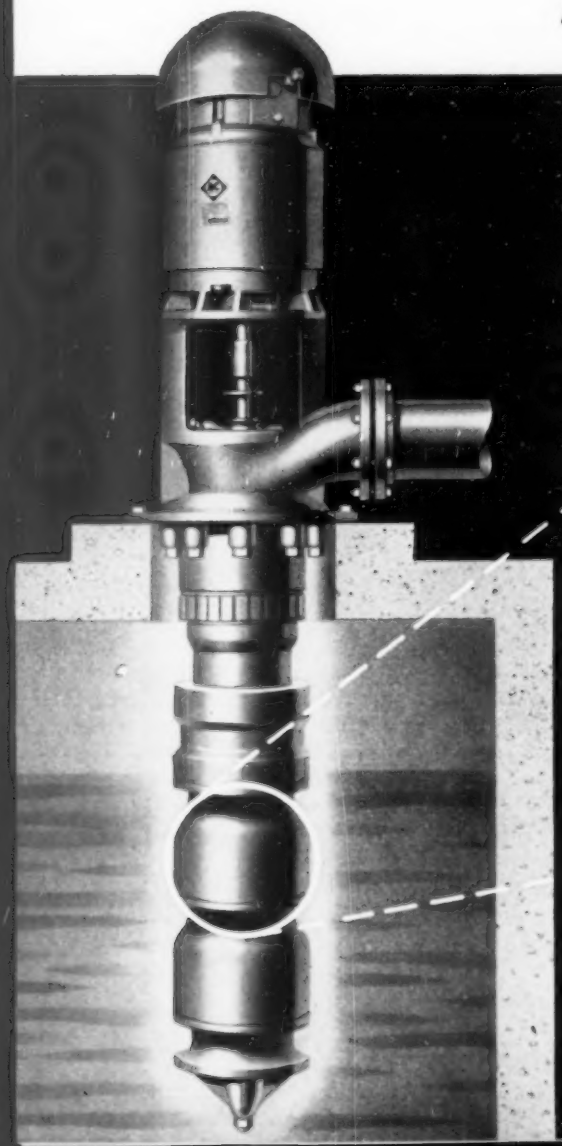
Pressures can be increased by simply adding a stage to the existing pump without increasing space requirements. Equipment and installation costs are low. Motor and discharge nozzle are supported by a single, small foundation. There's no need for suction pipe, interlock controls or priming equipment. Allis-Chalmers hollow-shaft motors remove the danger of open couplings.

Allis-Chalmers pump experts will be happy to tell you about this new addition to an outstanding line. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

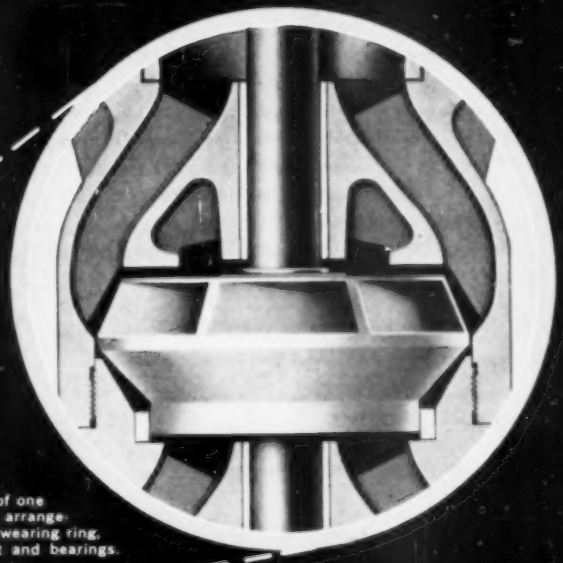
Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS

A-1163-GI



Many advantages — Self-priming • eliminate suction piping costs • save space, motor support and discharge nozzle are integral • low first cost • increase pressure easily • operate quietly • low maintenance with one stuffing box • no motor flooding.



Cross-section of one stage showing arrangement of bowl, wearing ring, impeller, shaft and bearings.

Many applications — Water systems, irrigation, condenser systems, bilge and sump service, dry docks, fire equipment, filter washing, recirculation, transfer pumping, process pumping, cooling condensers and diesel engine jackets, air conditioning, caisson and mine dewatering, general-purpose pumping.

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1-½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write today to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1. One Piece Piston
2. Hard Chrome Cylinder Bore and Piston Rods
3. High Tensile Steel Tie-Rods
4. Cushion Adjusting Screw, Externally Adjustable
5. New Super-Cushion for air, or Self-Aligning Master Seal for oil (T-J Patents)
6. Solid Steel Heads and Mounting Plates Standard all Models
7. Port Design Allows Minimum Pressure Drop on Inlet or Outlet
8. Chevron Type, Self-Adjusting Rod Packing
9. Piloted Packing Gland—Absolute Alignment
10. Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON
RIVITORS... AIR AND HYDRAULIC CYLINDERS... CUTTERS... CLINCHORS

SURVEY FOLLOW-UP
Begins on page 192

agement wisely decides to do a thorough job. Each case illustrates one of the problems listed across the top of the chart (pages 192-93).

• **Congestion** (Problem 3). A plant office employee wrote in this suggestion: "My desk is too small for all the papers that descend upon me at times." A study of the department from which this suggestion came resulted in developing a tier arrangement for work centers ahead of the employee who complained. This speeded up paper handling, smoothed out the peaks and valleys.

• **Housekeeping** (Problem 4). Women employees in a small office wrote in two complaints: mice, and old desks that snagged their stockings. A few mouse traps, and rubber edge guards—morale went up.

• **Work delays** (Problem 9). One company asked employees, "Do you have any objection to time clocks?" A large percentage answered "Yes." But further investigation showed the location, not the clocks, was the irritant. Employees were annoyed because they had to waste time getting to the clocks and back.

• **Boss's qualifications** (Problem 11). In a furniture plant of 230 employees, foremen of all production departments got high praise from their workers. But attitudes toward jobs, management, and company were on the low side. Investigation clearly was needed. It revealed an almost complete lack of supervision, which accounted for high production costs. Management clarified responsibilities, defined authorities, stipulated accountability, then started the slow task of teaching supervisors how to supervise.

• **Explaining** (Problem 15). Employees in a plant manufacturing complex electrical equipment indicated they often received orders from two or more persons. Investigation revealed that staff men worked closely with production employees and line supervisors to meet difficult customer specifications. Management decided close contact of staff men should continue, since supervisors welcomed their technical assistance. But employees were brought to an understanding of the reason for the dual supervision.

Turn the page

For more facts Circle 563 on Reader Service Card

For more facts Circle 564 on Reader Service Card ➤

2-year acid test! Open motor beats enclosed type at its own game

In a tough acid pump installation, Dow Chemical's Texas Division experienced no end of motor troubles. It seemed nothing could stand up in that humid, corrosive atmosphere. Reports Dow: "Even with totally enclosed motors, winding failures were frequent." And, they might have added, expensive.

Then came *Super-Seal* motors — Allis-Chalmers open-type motors with amazing *Poxeal* insulation. A durable case of epoxy-resin encloses the winding end turns and slot portions of the stator . . . the most complete protection ever developed. Result? The *Super-Seal* motor, after two years of continuous operation in the acid area, is as good as ever. So good, in fact, that Dow has ordered 150 *Super-Seal* motors for a new chemical plant at Freeport, Texas.

Isn't it time to revaluate *your* motor standards? There's a good chance that costly enclosed motors are no longer needed. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Super-Seal and *Poxeal* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

SUPER SEAL

A-1036-G1

ACID AREA APPLICATION. Safety equipment and clothing are a "must" for personnel in the acid atmosphere of Dow's chlorine plant at Freeport, Texas. This *Super-Seal* motor came prepared, too — with *Poxeal* insulation guarding the stator.

RAYMOND

COST CUTTERS

WALKIE PALLET STACKER

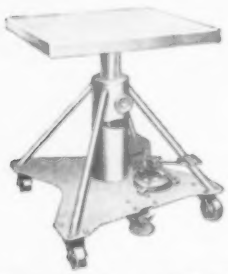
Tiers 2,000 lb. pallet loads 10 ft. high from 6½ ft. aisles. 24 volt power. Three speeds forward or reverse. Low price includes batteries and charger.

WALKIE PALLET TRUCK

24 VOLT POWER. Three speeds forward or reverse. Only 20½" longer than load. Low price includes batteries and charger. Capacity: 4,000 lbs.

LIGHTWEIGHT HYDRAULIC PALLET TRUCK

Rugged, maneuverable. 270° turning radius. Reinforced handle. One-piece formed fork construction. Separate lift and lower foot pedals. Cap.: 2,000 and 3,000 lbs.



PORTABLE HYDRAULIC ELEVATING TABLE

Positions work, supports long pieces, simplifies die handling. Convenient foot-pedal operation. Rotating top. Telescopic and non-telescopic models. Capacity: 2,000 lbs.

MAIL THIS COUPON

The RAYMOND CORPORATION

3288 Madison St., Greene, N.Y.

Please send Bulletins on RAYMOND Equipment checked below:

☐ Walkie Pallet Stacker
☐ Walkie Pallet Truck
☐ Lightweight Pallet Truck
☐ Portable Elevating Table

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

SURVEY FOLLOW-UP

Begins on page 192

• **Opportunities** (Problem 21). Older, high-paid employees of a street railway system saw no opportunities for advancement. A study revealed this was true. The problem was a toughie, complicated by seniority agreements, a pension plan, long-service employees. Good jobs outside were found for a few competent men, but no real solution was found. The company was frank about it—morale improved.

• **Opportunities** (Problem 21). An eastern life insurance company responded to the "no opportunity ahead" opinion with a search-for-talent program. Over a hundred employees voluntarily took aptitude tests, which brought several dozen "diamonds in the rough" to light.

• **Filling vacancies** (Problem 22). Employees in a mill complained the company did not promote from within. The president felt the employees were mistaken, since internal promotion was an avowed management policy. A check revealed that of the last 100 vacancies above starting jobs, 92 had been filled from outside. Thereafter every vacancy was posted, and employees were invited to apply.

• **Importance to community** (Problem 30). A small manufacturer of fans and ventilators was overshadowed in its town by a large steel plant, which aggressively sought local recognition. Employees of the small concern had little pride in their company. For one month the company paid employees and many suppliers in silver dollars, built newspaper ads around the stunt. The jingle of silver dollars changing hands for a few months was excellent public relations. And made employees feel important.

• **Jobs in same department** (Problem 31). "We prefer merit rating to seniority," said 90% of office employees in a shoe plant. So the company installed a merit rating plan—one that removed temptation from department heads to rate high—with a program to educate employees and raters about the plan.

• **Jobs in same department** (Problem 31). When the supervisors in a paper plant showed bad attitude toward their earnings, management was surprised. Discussion showed

This is a foreman dressing for work!

Time was when Pete wore the grubbiest work clothes he could find. He *had* to—with all the trouble-shooting he did. And as production fell behind he sometimes even had to fill in on a machine. What a waste of a good foreman!

Today, you'll find Pete in a white shirt—and tie. No longer does he do other men's work. Now he's the real right hand his management needs and wants.

Automatic Keysort Data Processing made the difference! Automatic Keysort now helps Pete and his management plan *in advance*, reports performance at every stage. Man-hours are used more profitably... and experienced foremen like Pete are free to concentrate on supervision, work assignments, production flow. Without extra bookkeeping, without having to pitch in themselves.

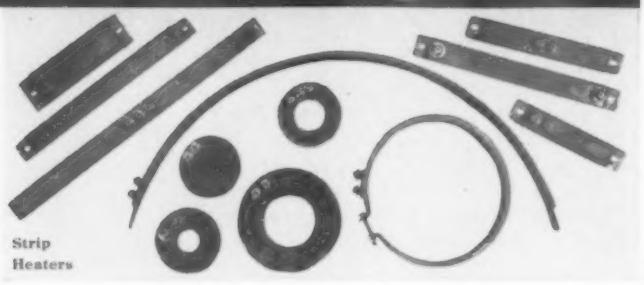
Automatic Keysort's easy-to-use machines and punched cards require no specialized personnel, no restrictive procedures. Designed to fit your business as it stands and as it grows, Keysort will give you all the fast, accurate information you need for modern management control of every factory operation. And at remarkably low cost.

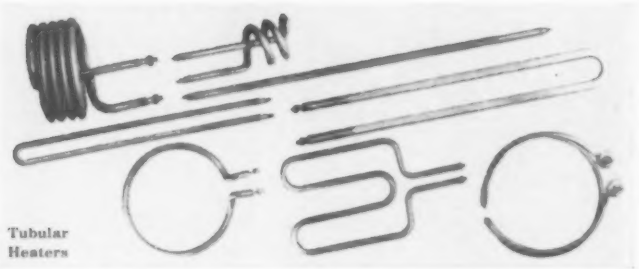
To learn more about how Automatic Keysort Data Processing can fulfill *your* needs for timely, comprehensive facts and figures, call your nearby Royal McBee Data Processing Representative, or write Royal McBee Corporation, Data Processing Division, Port Chester, N. Y., for brochure FS-33.

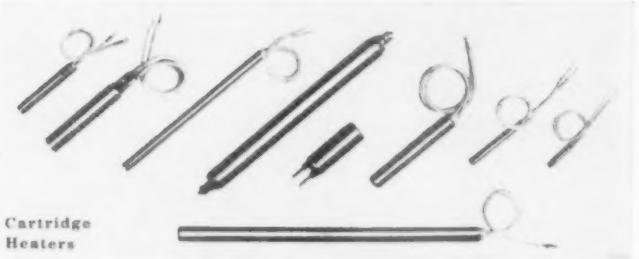
ROYAL McBEE · *data processing division*

NEW CONCEPTS IN PRACTICAL OFFICE AUTOMATION

Call your CHROMALOX Man for the heating answers







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Begins on page 192

that overtime was the villain—several machine tenders were taking home higher earnings than the foreman. Management instituted a differential bonus, calculated and paid at the end of the year, so each foreman would receive at least 15% more than his highest-paid worker.

• **Jobs in other departments** (Problem 32). Salaried employees in a large box plant had lower morale than production workers—reversing the usual finding. It didn't take long to discover that the unionized plant employees had won increases and vacation benefits that had not been granted salaried employees. Although the salaried employees didn't want to unionize, they resented management's discrimination against them. The answer here was obvious.

• **Jobs in other companies** (Problem 33). The employees in a candy plant thought company rates were lower than paid by other candy manufacturers in the area. Management knew this impression was incorrect. Two area rate survey "teams" were formed—the union president with the personnel manager, and the union secretary with the industrial engineer. The two teams visited competing companies to exchange hourly rate data, then compiled a comparison of company vs. community rates. It showed the company well above average, and the issue disappeared.

• **Medical aid** (Problem 40). "First aid is poor," said night-shift employees in a steel fabricating company. Investigation showed the equipment was adequate, but few employees knew how to administer first aid. A serious accident had occurred recently on the night shift, and nobody had the skill to prevent a tragedy. Management started first-aid instruction—for office, as well as night and day shifts.

• **Media for information** (Problem 44). The president of a highly decentralized gas and electric company wanted to explain to employees the findings of an attitude survey. Not satisfied with a printed report, he drew a series of charts, built a sound slidefilm around them. Had it shown at all company locations. Result: better understanding and improved morale. **END**

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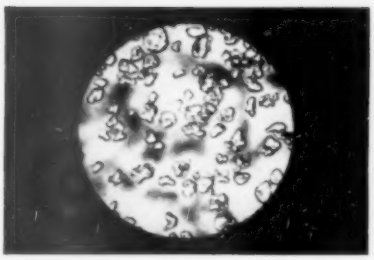
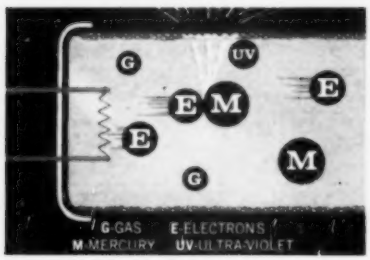
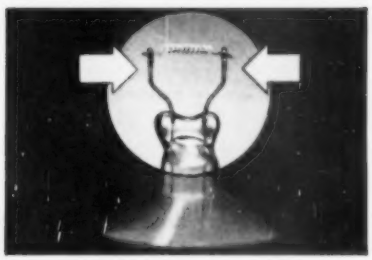


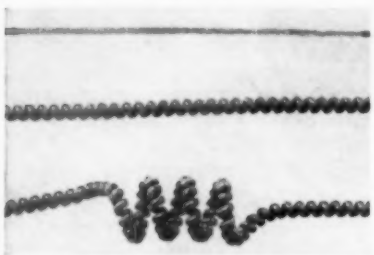
Ultralume™ Phosphors: Westinghouse research has proved that the size of the individual phosphor particles which coat the inside of a fluorescent lamp have a direct effect on the amount of light given off. Now, a new and exclusive Westinghouse process selects the right particle size for more efficient light-producing phosphors.



Mixed Gases: All fluorescent lamps contain mercury and gases. The gases serve as conductors until the mercury is vaporized. These gases and mercury vapor then convert electricity into ultra-violet radiation, which causes the phosphors to "fluoresce." Westinghouse uses the right mixture and pressure for each type of fluorescent lamp.



Plated Leads: The electron bombardment inside a fluorescent tube eventually causes particles of the metal supports and leads to sputter off causing "end blackening." To prevent this, Westinghouse plates the lead wires with super-hard chrome-vanadium. Result: tubes that *stay* brighter, end to end.



Triple Coiled Electrodes: Westinghouse uses triple wound electrode coils to hold the right amount of emission material. This carefully measured amount is heated quickly and adequately protected from bombardment to insure long life and trouble-free starting.

"Custom" Anodes: Anodes act as buffers and prevent excessive "sputtering" of emission material from the electrodes. Since the electrical characteristics are different for each type of fluorescent lamp, Westinghouse anodes are especially engineered to fit the electrical requirements of each type of lamp.

Silicone "Raincoats": In high-humidity areas, moisture can collect on the exterior surface of the lamp and prevent it from starting. To protect against moisture accumulation, Westinghouse fluorescents are given a special Silicone coating, or "raincoat," which disperses this film into harmless droplets.

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By PAUL A. KING, Attorney, Bigelow-Sanford Carpet Company, Inc.; Member, New York Bar

More Arbitration Action in the Federal Courts

Employers and unions are turning to the federal district courts to enforce arbitration awards and recover damages. Here's how they're making out.

Not too long ago, the U. S. Supreme Court (in the Lincoln Mills case) approved federal court use of Section 301 (a) of the Labor Management Relations Act of 1947 as a means of compelling employers and unions to arbitrate. Result: Labor relations attorneys on both sides went to work to see how busy they could keep the federal courts in enforcing arbitration. They also tried to see how much more relief the federal courts would be prepared to give.

Several recent cases illustrate the results of these efforts. Because the statute has taken on so much significance, let's look at its cold print:

"(a) Suits for violation of contracts between an employer and a labor organization representing employees in an industry affecting commerce . . . or between any such labor organizations, may be brought in any district court of the United States having jurisdiction of the parties, without respect to the amount in controversy or to the citizenship of the parties.

"(b) Any labor organization which represents employees in an industry affecting commerce . . . and any employer whose activities affect commerce . . . shall be bound by the acts of its agents. Any such labor organization may sue or be sued as an entity and in behalf of the employees whom it represents in the courts of the United States. Any money judgment against a labor organization in a district court of the United States shall be enforceable only against the organization as an entity and against its assets and shall not be enforceable against any individual member or his assets."

In one case that occurred since the Lincoln Mills precedent the union sued to recover the unpaid wages of employees and to compel the company to allow them to exercise their pension and insurance rights under the bargaining contract.

The Circuit Court of Appeals at Chicago heard this case and ruled that it was an action for recovery of individual benefits due employees—so could not benefit from Section 301. It said that Section 301 was reserved "to matters which, whatever the personal interest involved, directly and primarily affect the complaining union as an organization, and to procedural controversies about the proper administration of the collective bargaining process for which the union as bargaining agent is responsible." Personal rights of employees are not covered by Section 301.

The court reminded the union that its case was similar to the earlier Westinghouse case in which the Supreme Court ruled the same way.

The union, in self-defense, pointed to the court's previous holding in the Ford Motor case. But the court said there was a difference: "In the Ford Motor Company case we held that a labor union could maintain an action in federal court under Section 301 (a) for the breach of a labor contract arising from the alleged wrongful dismissal of an employee. However, in that case the union predicated its action on the employer's refusal to recognize . . . that the grievance procedure provided in said collective bargaining agreement . . . be utilized as a means of attempting a settlement of the wrongful dismissal of the plaintiff. This was a clear breach of the bargaining agreement and involved a right flowing directly to the union. There is no charge, in that case, that the union sought to invoke. Or that the company refused to submit to the grievance procedure set out in the agreement."

Several hundred miles away, a federal circuit court judge at Richmond concluded that a federal court had jurisdiction under Section 301 to order specific performance of an arbitration award granting reinstatement with back pay to a discharged employee.

The court completely ignored the employer's contention that a personal right of an employee was being enforced. In justification, it referred him to the court's decision handed down the same day in a textile worker's case. There the court directed specific performance of an award ordering an employer to reimburse workers for loss of unemployment pay. It reasoned: In the Lincoln Mills case the Supreme Court ordered the parties to go to arbitration—enforced the arbitration clause of the contract. Here the parties had gone to arbitration, so it was a question of enforcing the arbitrator's award. If arbitration can be specifically enforced, the court should have power to afford complete relief by enforcing the award.

Don't Pay Overtime Twice

Failure to equalize an employee's overtime can mean payment for overtime twice. It did here.

Most contracts provide that employees are to dip into the overtime pot on an equal basis. This means the employer must watch overtime hours worked by each employee in the group—must equalize it as best he can.

A real problem pops up when an employee, who has been discharged (or suspended) by his employer and reinstated by an arbitrator, puts in a claim for lost overtime opportunities. Or when the company inadvertently neglects to equalize in accordance with the contract's

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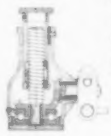

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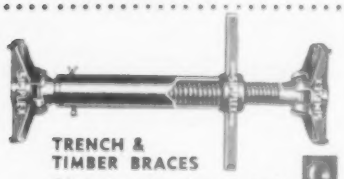

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provisions. Paying out the lost overtime again penalizes the company. Requiring the company to make up and equalize within a reasonable time seems fairer. It's more to the liking of employers, anyhow.

Unfortunately, as Arbitrator John F. Sembower recently pointed out in a case of this kind, although some arbitrators follow this latter view, most don't. Most penalize the employer. But penalize is a word not favored by Sembower. He made the company pay twice for inadvertent lost overtime and called it an award for violating a contract. The company has the responsibility of administering the overtime equalization system.

Double Punishment Won't Do

Reprimand or layoff—but not both, rules this arbitrator, as he reviews the case of two employees with the habit of knocking off early for lunch.

In the Diamond T Motor Truck (Chicago) contract, the disciplinary clause was typical. It read: "The company may discipline employees for just and sufficient cause by reprimand, disciplinary warning, notice, disciplinary layoff, or discharge."

Also not unusual was the employer's reprimand slip which read: "You are hereby put on notice that this reprimand is a matter of record. Any future occurrence will result in further disciplinary action."

What was unusual was the interpretation the company put on the clause. And in this is a lesson for executives who mete out plant discipline.

Two employees knocked off a few minutes before the scheduled lunch hour. Each was given a reprimand slip. It happened again and each received a second slip. Nothing like a reprimand worried these two employees. They once more left early and the company's foreman dished out reprimand slip No. 3.

The trouble began when (the next day) the industrial relations office laid off the workers for two days. The cry went up: "This is double jeopardy." "They can't do it," claimed the union.

The company's case revolved around the foreman's lack of power to mete out discipline. Only the industrial relations department was authorized to do this. Thus, as the company looked at it, the reprimand slips were not discipline measures. Ergo, no double jeopardy.

This view, said the arbitrator, "flies in the face both of the contract language and the wording of the reprimand form. The contract expressly states that a reprimand is one of the types of discipline that the company may impose. This same provision contemplates that a written reprimand will be entered in an employee's employment record . . . that a formal reprimand will be in effect for 18 months after issuance."

Finished with the contract clause, the arbitrator pointed out that the reprimand slips talked of "further disciplinary action." And, in his own words, "the conclusion is inescapable that the two-day suspension here involved was not for just and sufficient cause." It was a case of double jeopardy.

Turn to page 218

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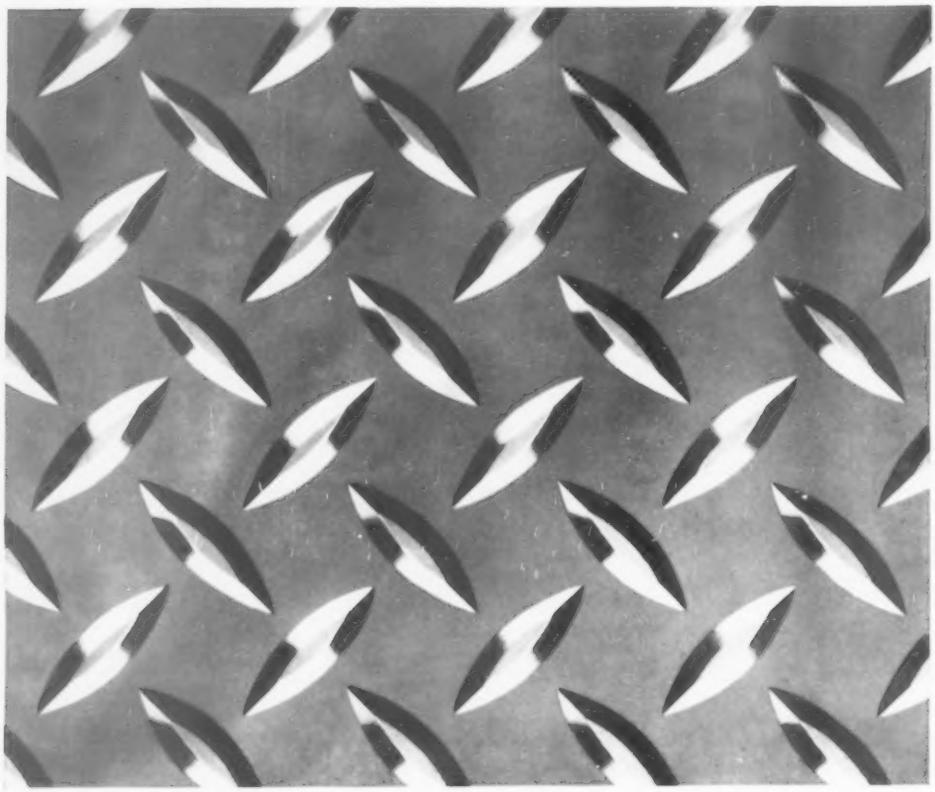

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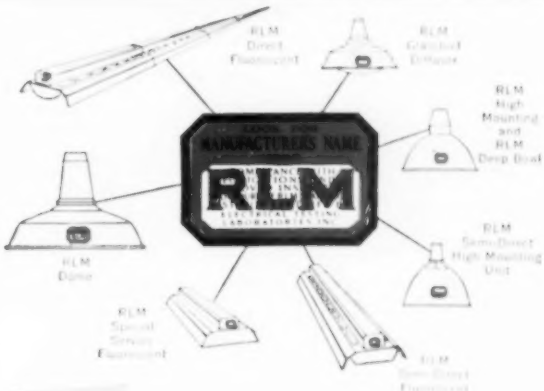

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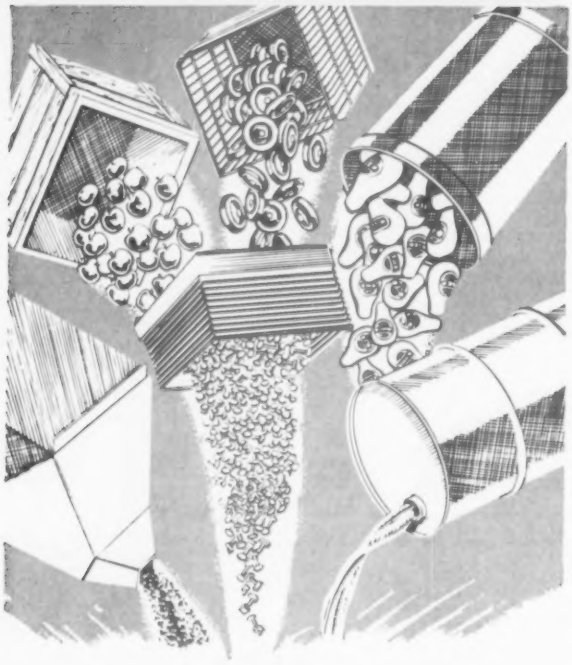

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Begins on page 212

Last Wages Not Taxable

Wages during an employee's last illness are not subject to withholding.

Your payroll department no longer need wrestle with this one. The federal income tax people have ruled that wages earned by an employee during sickness and paid by your company to his beneficiary or estate if he dies at end of the illness are not subject to withholding—either Social Security or income taxes. What's more, to the extent that it is sick pay under the income tax rules, it need not be included in the taxable income of the deceased or his beneficiary or estate.

Straight Time for Funerals

Employers suffer when they have to pay time and a half for hours actually worked. Can you imagine this company's reaction when an employee demanded premium pay for time spent at a funeral?

Lev Staggs' brother died. Lev went to his funeral. Took the day off. The contract said he could—with pay. Next week when he counted the bills in his pay envelope, he got sore as a boil. What he counted did not add up to time and a half for the time spent at the funeral.

As Lev and his union saw it, if the contract said he could take a day off for the funeral with pay, it meant that in computing overtime for that week you add in all the hours worked (in this case 48) and pay overtime for hours over 40. It's nice figuring, said the company, but funeral pay is a special benefit not related to overtime computation. Said employee Lev Staggs, "Is that so?" He brought his case to arbitration.

The arbitrator agreed with the company. "Overtime pay is awarded only for periods actually worked" unless the contract provides otherwise. And this one didn't.

Let's be on the safe side next time we draft an overtime clause—be sure to spell out what we mean.

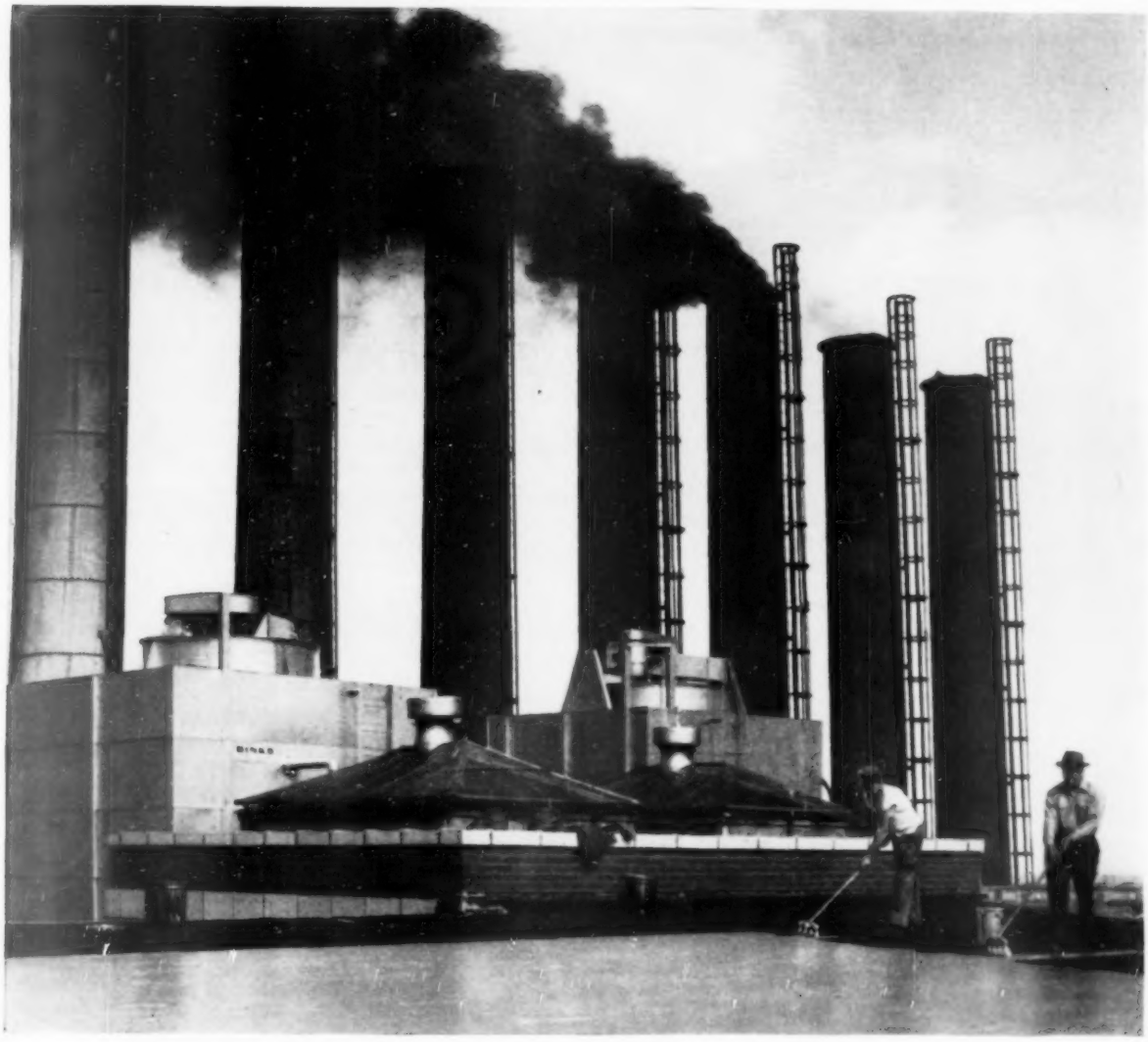
Truth Stretchers Lose Out

Two apt—but unparlorlike—words describe many a union's pre-election campaign statements. But this time, a court clamped down.

There's a saying: Nothing succeeds like success. So when union-minded Sam Jones told fellow-employee Johnnie Bowman that *a majority* of the shop had already signed up with the union, Johnnie went along. Signed up too. But it later turned out that it was Johnnie's card that made up the majority. When the company found this out, it refused to recognize the union—refused to bargain with it.

An NLRB trial examiner and the Board itself ordered the company to fall in line anyhow. However, a federal court overruled both.

Said the Board: "Jones's conduct was not of such a character as to invalidate Bowman's designation. This sort of claim of success on the part of union organizers, though untrue or exaggerated, is not fraud affecting



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the employees' grant of bargaining authority. On the contrary, it is clearly quite common and harmless sales talk which is ordinarily not taken seriously by employees to whom it is made. In any event, it is subject to ready check by employees as to its truth."

This approach may have made sense to the Board, but it did not to the reviewing court. "Sure," the court said, "if an organizer made such a claim of success prior to a secret ballot election, it may very well be that its effect would be negligible. There would be no reason for the employee in voting to give much weight to whether or not he was on the winning side." But in this case, the court felt, Jones's statement actually misled the employee, who had no way of checking its truth.

The court's conclusion: The company did not violate the law in refusing to bargain with the union because the union was not freely designated by the majority of the employees in the bargaining suit.

One Word Saves Arbitration

From now on, this union will watch its "shalls," "musts," and "mays." By use of the wrong word, it sacrificed its right to demand arbitration.

A Procter and Gamble union found that its arbitration clause was as slick as the company's product, but much too slick for comfort. You can bet your bottom buck that from now on all clauses will be closely examined by the union's department of semantics before any union John Hancocks are placed on new contracts.

The union asked a federal district court to compel P & G to arbitrate its failure to post a job after a new machine was brought into the plant.

With clear logic the court set this task for itself:

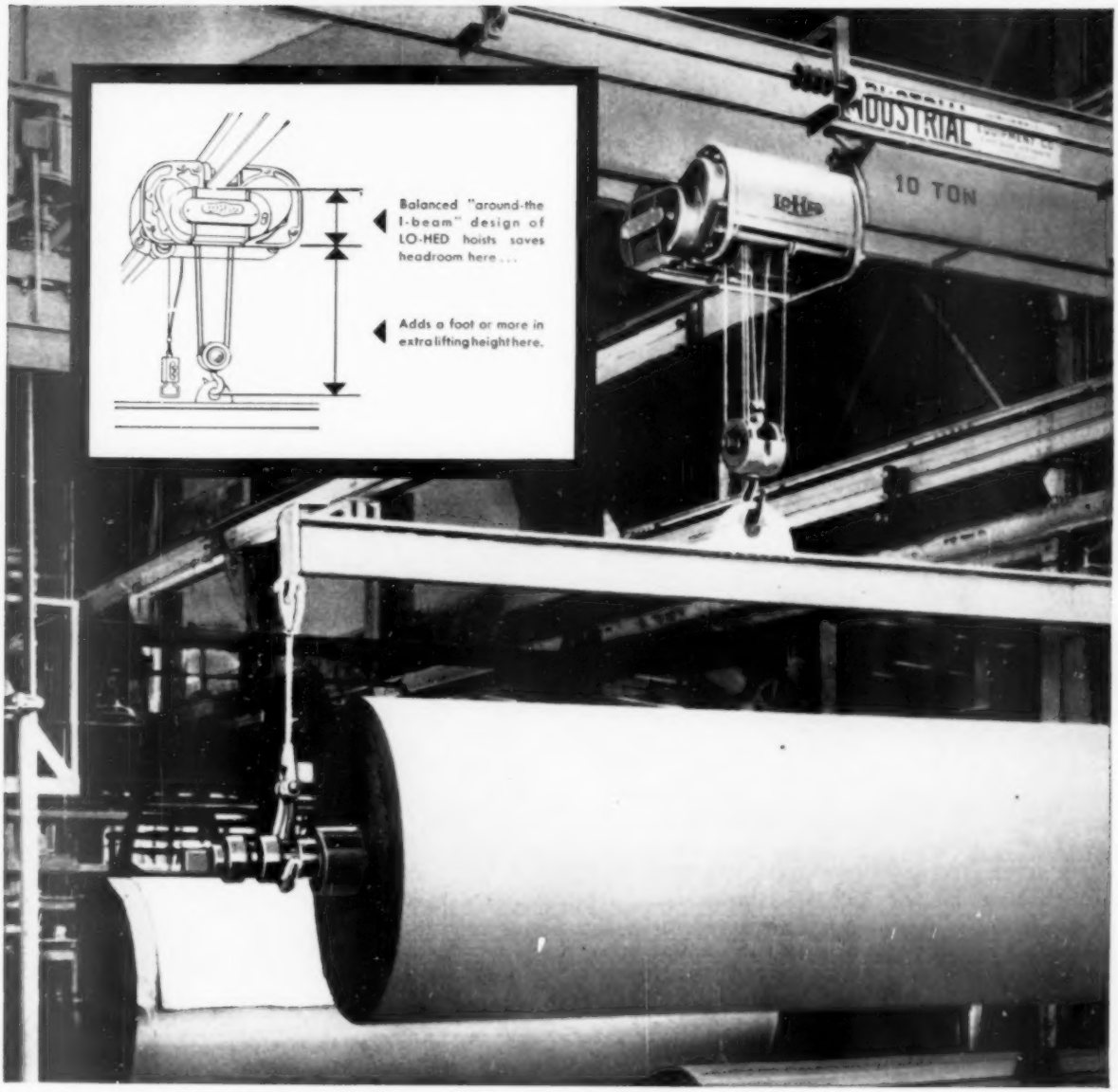
1. Does the court have power to entertain an action for specific performance (arbitration) of a collective bargaining agreement? Answering itself, under Sec. 301 of the Labor Management Relations Act of 1947, the court replied "It does."

2. Was the question of arbitrability left to the arbitrator or to the court? This was a question of contract interpretation. Answer: the court. The contract gave arbitrators the power only in disputes submitted by the parties—and only for the issues stipulated.

Thus, taking hold of the case, the court held that because of the wording of the arbitration clause, it couldn't order specific performance.

The clause read: "In the event that this procedure does not accomplish speedy and satisfactory adjustment, any grievance having to do with the interpretation or application of any provision of this agreement *may* be submitted to a Board of Arbitration. . . In the event that arbitration is called for by either party hereto, the Employer and the Union shall each appoint one arbitrator within fifteen days after such request."

The arbitration clause, said the court, "does not make mandatory the arbitration of any dispute concerning interpretation or application of the provisions. The clause says that any such grievance *may* be submitted to arbitration."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Adds a foot or more in extra lifting height here.
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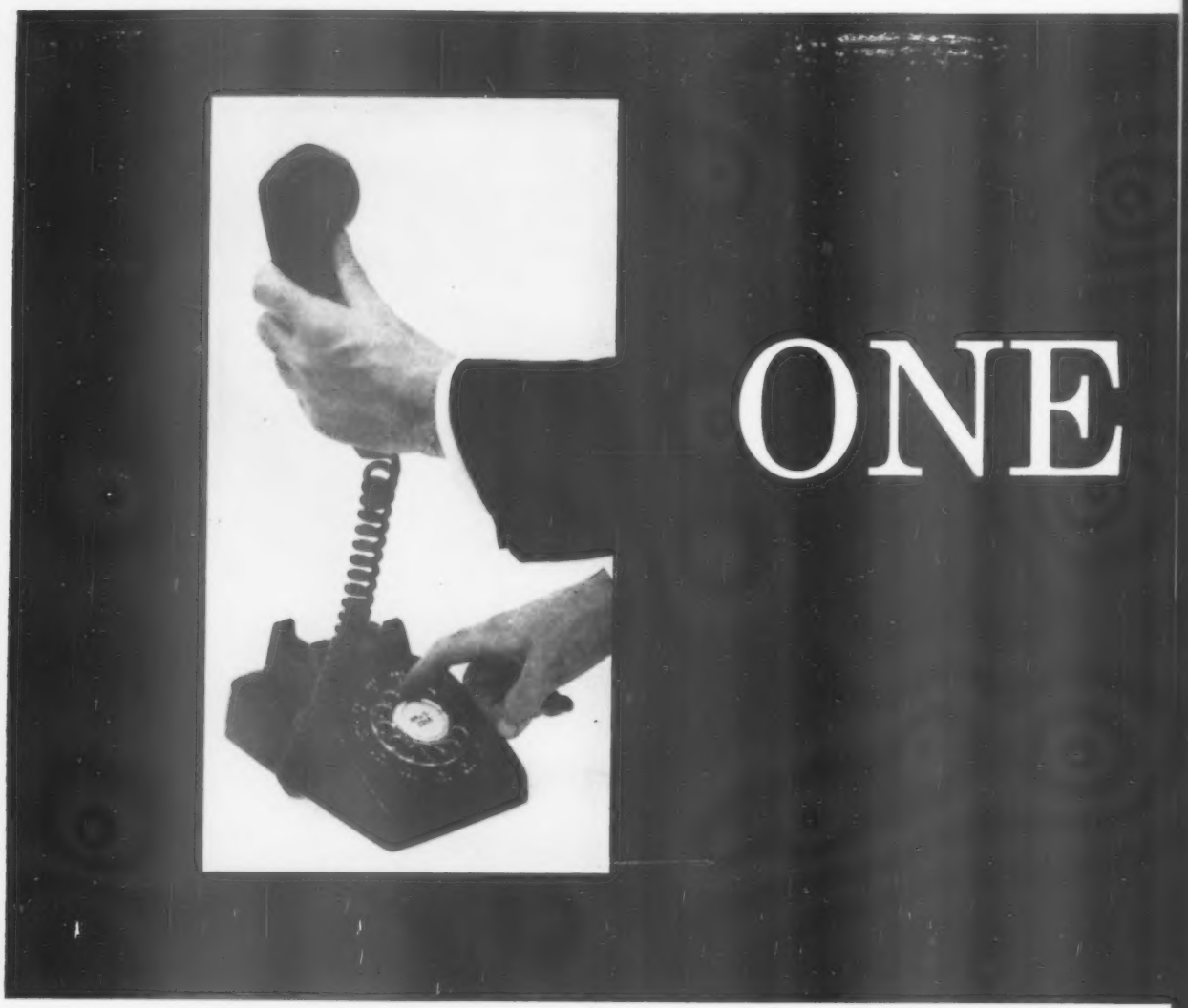

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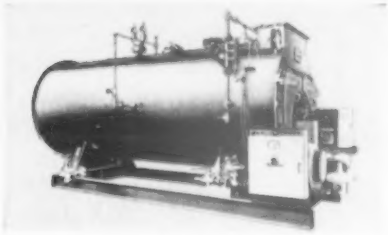
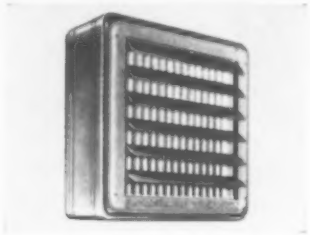


Vertical and horizontal unit heaters for steam or hot water; also gas-fired.



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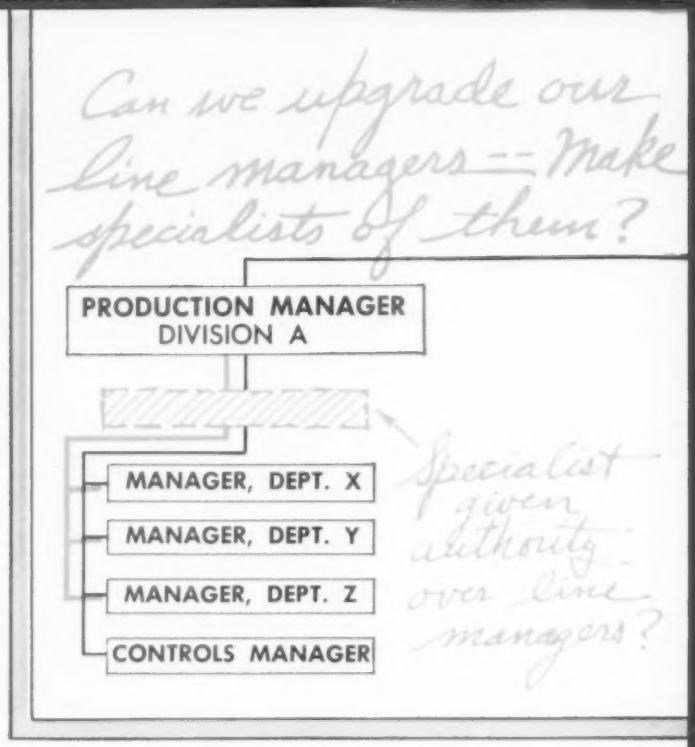

Can we upgrade our line managers -- make specialists of them?
PRODUCTION MANAGER
DIVISION A
MANAGER, DEPT. X
MANAGER, DEPT. Y
MANAGER, DEPT. Z
CONTROLS MANAGER
Specialist given authority over line managers?

Hero or villain? Depends on how you handle him. For handle him you must—or he'll unscramble your work patterns, your organization, your plans. Doodles like these are dead serious when you're . . .

Fitting Today's New Specialist

MANAGEMENT men today go through many a drama like this:

Scene: A management office.

Characters: Tom Mace, general foreman; and John Wallace, works manager.

Mace: Who's my boss, Mr. Wallace? That's all I want to know. I thought you were. But that quality control engineer has been running my equipment. And now he's trying to run me. How do you think it looks to my men—a 25-year-old kid giving me orders?

Wallace (wearily): Come back later today, Tom, and we'll discuss it when you've cooled off.

Mace: I'll be back. But I won't be cooled off. (He leaves.)

Wallace (as the door slams): Who *is* his boss? I wish I knew.

It goes without saying that the off-stage character, the quality control engineer, is the key figure in this little drama.

The situation typifies the collapsing work patterns caused today by the advent of the specialist—quality control engineer, production engineer, operations researcher, systems and procedures analyst. Already he has moved into thousands of companies. Soon he'll be moving into tens of thousands more.

Where does he belong in the organization? Doodling for an answer (chart above) will help. But you'll have to go deeper, too.

NEW PROBLEM IN PLANTS

The specialist is the advance scout of our new technology. He's the most significant management development in the last 15 years. But in approaching and opening the Pandora's Box of the future, he has loosed some stinging problems that buzz about management's ears.

The same factors that produced the specialist eventually will bring more changes in technology. But the specialist himself is an immediate problem. The company that's unprepared for his presence within its walls suffers. The organization and the people in it become disoriented. Putting it another way, management will lose the benefits of technical advances in operations unless it can solve the related problems. Management must face up to—and deal with—the technicians who are needed to man the new machines.

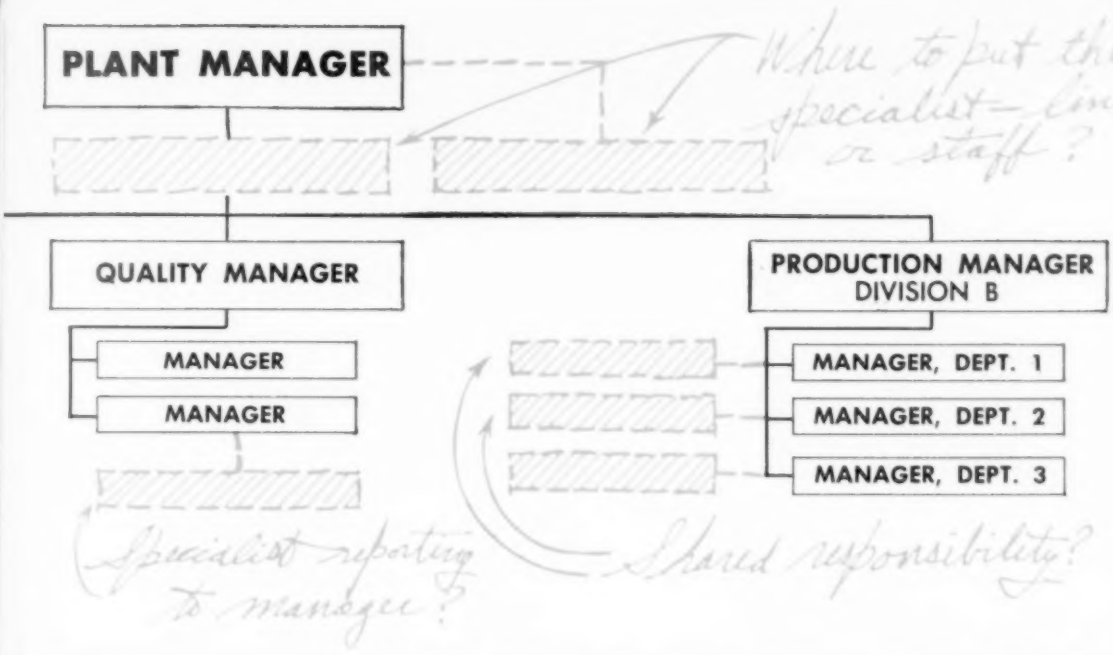
How widespread is the specialist? A special dispatch to *The New York Times* of Dec. 31, 1958, provides some insight:

"Skilled Workers Reported Scarce —Presidential Advisers Warn More Are Required for Scientific Revolution," read the headline.

The dispatch continued: Dr. Howard L. Bevis, chairman of President Eisenhower's Committee on Scientists and Engineers, told the President that the new "scientific revolution" would have "a deep influence on our whole way of life." Dr. Bevis went on to say that there is an ever-growing need for more highly trained and highly skilled manpower to support a larger population, a rising standard of living, an increasingly complex technology.

Specialists (other than hourly rate technicians needed to man and maintain complicated new machines) are a problem because their management role is ambiguous. Companies have trouble assimilating them because, like our fictional Works

By AUREN URIS
Research Institute of America
New York City



Into Your Plant Organization

Manager John Wallace, management isn't sure just where they fit in.

There's no longer any point in asking whether the specialist is hero or villain of the piece. He's on the work scene to stay and his numbers are growing—fast.

The question he creates must be answered. It's this:

• How can the company organization—and the people in it—best adjust to the changed circumstances the specialist brings with him?

And there's a corollary question about the problems the specialist himself faces:

• What can the specialist do to resolve the contradictions and difficulties of his own situation?

The answers to both these questions lie in the work scene itself. To understand and solve the problem, look at two areas:

1. The pre-specialist situation. Company organization followed traditional lines. The function, degree of authority, and relationships among the individuals in the company were pretty well established.

2. The new situation. When the specialist comes on the scene, he disturbs the old patterns. The changed needs in lines of authority and communications further reveal the dimensions of the problem.

A brief examination of the two areas reveals some of the causes of difficulty.

WHY TROUBLE COMES

John Wallace, our fictional works manager up above, is puzzled. He's baffled by the problem his general foreman brought him. The quality control man's role is hard to pin down. Why? Not because organizational history offers no clues, but because the clues that exist are confusing.

Fact is, the problem seems to have a precedent. It appears to be the well-known line-staff friction between the front-line manager and the staff specialist. It's as old as company organization.

In the "olden days" management had a traditional solution to the problem. The foreman, king of his realm, was instructed to tolerate intrusions from staff men—but to retain undisputed control.

Instructions to the staff specialist were just as explicit: "Look into the situation in X Department. But don't talk to the employees unless it's okay with the foreman. And don't talk to the foreman if you can help it. Talk to his boss."

The classic company structure—in a service organization as well as a production organization—provided the context for this situation.

Classical organization—In most plants there's a separation of production (line) and service (staff). The contacts that occur between line and staff take place on a "courtesy" basis. The staff specialist, such as the budget manager, seldom needs direct contact with line personnel. He gets his information from records. Generally, any communication that is more than perfunctory takes place in the higher echelons. For example, between controller and production manager.

The relationships within the line organization are clear and unambiguous. Everyone knows who his boss is. Communications channels are well defined. If a middle-management executive wants to check on any aspect of line operations, he knows the foreman is his man.

Turn the page

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TODAY'S PLANT SPECIALIST
Begins on page 224

The line-staff type of organization is seldom flexible enough for the new functions and duties of the specialist. Where he's involved in line activity, functional relationships and flow of information often become fuzzy. Content of communications becomes more technical. Also, a split develops in the source of operating knowledge between supervisor and specialist. This poses a problem for management—especially for the middle manager.

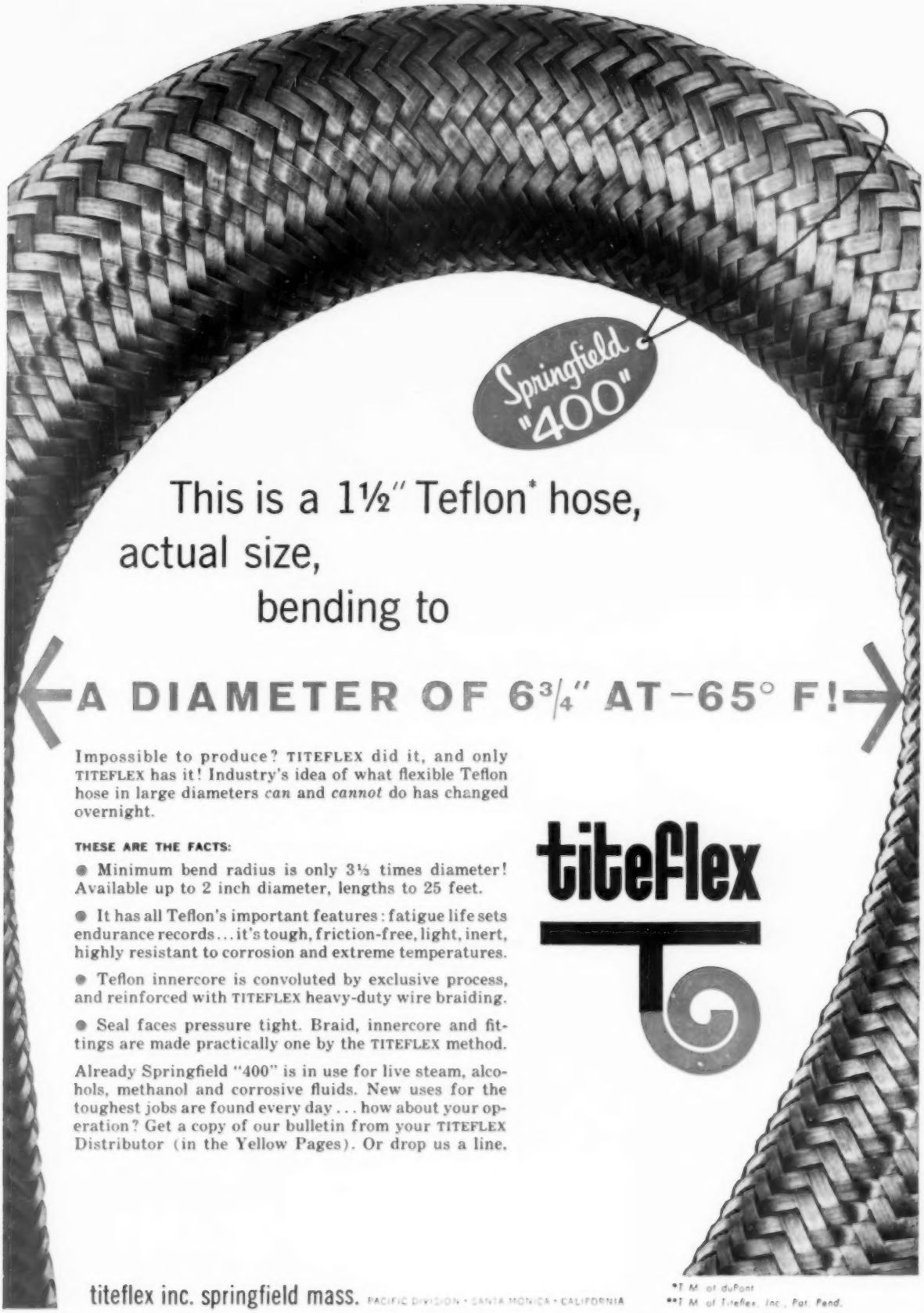
An illustration of the work scene after the specialist comes in will pin down some of the complications. Take a common-denominator example—the situation in a radio-TV organization that installs automatic assembly equipment:

Gone are the dozens of female operators working at their stations with assembly tools and soldering equipment. In their place is an automated line with a dozen stations. At each station an assembly operation is automatically performed. Of course, the complex operation still requires people. But instead of many assembly workers and a foreman, the new set-up requires two operators, an engineer who knows how to keep the equipment running at optimum levels, and a man who may have the title of foreman but whose duties are clearly different from those of his unautomated predecessor.

The specialist in the new set-up—maybe he's called production engineer—is no longer an occasional visitor to the production floor. He is concerned with production—hour by hour, minute by minute.

The role of the foreman also is changed. Where he once controlled many people, his roster now is sharply reduced. He used to be undisputed head of his department, largely because he knew better than anyone else what was going on there and how to control the factors that resulted in production. Now it's the engineer who holds the reins. The supervisor takes a back seat.

True, the foreman is "in charge" of the employees. He schedules their work, keeps track of attendance, listens to complaints of a shortage in pay, or arranges for a few hours off when requested. But



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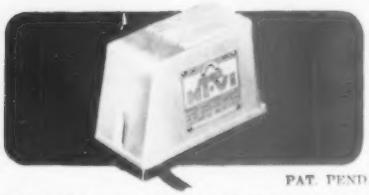

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ERIEZ

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TODAY'S PLANT SPECIALIST

Begins on page 224

even more significant changes have occurred in his relationship up the line—with his boss, for example.

Changes in his job aggravate the foreman's edginess and insecurity. He's no longer king of all he surveys. Bit by bit, piece by piece, his authority has been snipped away. Pressures of union contracts and the need for uniform administration among departments are only two of the factors that have shorn this front-line Samson. The net effect is to make him jealous of the prerogatives and status he still retains, and, therefore, more of a problem for the specialist to team up with.

HOW MANAGERS GET HURT

So far we've largely confined our look to the operating level. But the specialist problem gets bigger when viewed from higher up on the organization ladder.

Consider it from the viewpoint of the middle manager, usually the specialist's boss. In the technologically uncomplicated days, his lines of communication were clear-cut. He could get anything he wanted to know about operations directly from the foreman. But now his communications problem becomes difficult. Many times, answers to his questions require information from both foreman and specialist.

Can Department X produce 50,000 gadgets on special order before the end of the month? The engineer has to supply information about equipment performance; the foreman about availability of personnel, supplies, and so on. And to the question "Can we get out the parts in time?" there may be a difference of opinion between engineer and foreman. Imagine the problem the manager faces in getting his two subordinates to agree on the answers if there is friction between them.

The middle manager must face the touchy situation created by the changed role of his supervisors. The supervisor whose job has caved in under the weight of technological changes sometimes becomes fretful and discontented. He's a deposed monarch. He yearns for his past glory and dislikes the new ways.

But grudging acceptance is not the

ONLY ERIEZ

has a *complete line* of permanent non-electric

GRATE MAGNETS

designed to specifically

STOP TRAMP IRON and IRON FINES

ONLY ERIEZ Grate Magnets offer the widest selection of models, sizes and construction in the widest price range . . . either strong, proved-in-use ALNICO magnetic elements or new, low-cost CERAMIC material.

ONLY ERIEZ has units designed for *your exact needs* – with the most effective, most powerful magnetic fields – protected by U. S. and foreign patents.

ONLY ERIEZ – world's leading producer of magnetic equipment for industry – has the experience and know-how to provide the most effective Grate Magnets:

For tramp iron separation – Eriez Alnico-powered Grate Magnets **proved stronger** than all comparable units in extensive, controlled tests. Alnico is also highly effective for fine-iron separation.

For fine-iron separation – Eriez Ceramic Grate Magnets proved best for efficient, economical removal of fine-iron in free-flowing materials.

All Eriez Grate Magnets are non-electric, self-contained. Operate without any wires or attachments. Designed to prevent choking possibilities caused by bridging of iron and material accumulation. First cost is only cost. Ruggedly constructed; magnetic tubes permanently secured to frame, can't fall into flow line. No operating or maintenance costs. Available in: Wing-Type, Drawer-Type, Multiple-Bank, Rotary-Type, Odd-shaped Models, Housed Units, and Housed Vibratory Units.

Get all the facts . . . Write today

Eriez Mfg. Co., 70-WA Magnet Dr., Erie, Pa.

ERIEZ

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Which bearing is right for you?

Play it safe! Do business with your AUTHORIZED FAFNIR DISTRIBUTOR

All of these ball bearing pillow blocks are the same make. They all take normal loads and fit the same size shaft. All have the same type seals.

But each is different from the others in base-to-center-height dimensions and bolt-hole spacings. Which would best meet your needs? The correct unit is the one which fits your machine design, eliminating the need for shims or other mounting accessories.

To be sure the bearings you buy are best for the job, do business with an Authorized Fafnir Distributor. He's a bearing specialist . . . knows what bearings are best for you. The expert help he can give you is a valuable extra you get wherever you find the Fafnir sign.

And, by ordering from your Fafnir Distributor, you avoid the risk of equipping with obsolete bearings, or units that are second-best substitutes for the job at hand. Your needs are met from stocks of the latest manufacture and design.

So play it safe! For the most effective and cooperative help with ball bearing selection, supply, and service, it always pays to do business with your Authorized Fafnir Distributor.

THE FAFNIR BEARING COMPANY, New Britain, Connecticut

Delco delivery

Delco Delivery Time

How does this fit in with your production schedule! Delco Products offers from in-stock to three weeks delivery on integral h.p. polyphase motors. This includes rerated 182 through 445U frame sizes. In many cases overnight delivery is available! A modern assembly system, geared to your needs, makes this type of quick delivery possible. Now you can be sure of faster delivery, plus the quality and performance for which Delco Motors are famous. Always call Delco Products for the best possible motor in the least possible time.

DELCO MOTORS

Delco Products, Division of General Motors, Dayton, Ohio
Branch Offices in Principal Cities

For more facts Circle 585 on Reader Service Card

TODAY'S PLANT SPECIALIST
Begins on page 224

only reaction possible to the supervisor. The middle manager's inability to anticipate front-line management's reaction will add more fuel to the already overheated relations between specialist and foreman.

TAKE COMPANY Q

Some time ago Company Q, a maker of electronic components, was forced to recruit new supervisors and middle managers from the specialists' ranks. Noting how poorly old-line supervision was faring under the impact of technological changes, it decided it would handle festering supervisory dissatisfactions by setting a clear policy. It went like this:

"Advancement for supervisors is no longer in the cards. The trend toward advanced types of production tools will continue. Eventually, only individuals with engineering backgrounds can be considered for management positions."

The furor that ensued caught management completely off balance. What? End the possibility of promotion for an entire level of management? That wasn't democratic, and supervisors demanded the whole question be opened for discussion.

The supervisors posed a number of questions:

- Has management forgotten the great performances supervisors have turned in in the past?
- Doesn't management believe that, at least at the top of the supervisory group, there are people who can master the new techniques?
- Doesn't management believe that its own training and development methods can equip some supervisors for middle-management positions?

Top executive men, subjected to this bombardment, capitulated. They threw out the policy they had evolved and substituted the efforts the questions had suggested—technical training to equip supervisors to hold their own, and even to advance up the management ladder.

It would be nice to be able to report a happy ending. Unfortunately, aroused feelings cut a dividing line through management personnel. One executive privately suggested that the respective groups

How Weber Address Systems Help Ship "HEET"® 4 Hours After Order is Received

Using "touch-stenciling" and TAB-ON stencils integrated with order processing paperwork, the company now ships faster, more efficiently, saves time and reduces costs

DeMert and Dougherty, manufacturers of famous "Heet" gasoline additive, must schedule their production and shipping lines according to advance predictions of the winter's severity throughout most of the United States and Alaska. Every operation in the company's eleven acre plant at Cicero, Illinois is geared to speed, flexibility, and efficiency. According to the company's time standards, the order processing operation, which includes typing, routing to the traffic department, sending to shipping, addressing and loading is accomplished in less than four hours. A Weber addressing system helps them accomplish this speed. . . . Weber "Tab-on" stencils are typed over the order invoice papers when the order is re-received. In the shipping department, the stencil is inserted in a hand-printer and all pieces of the shipment are individually addressed with a clear, sharp, permanent impression. With a smooth, one hand motion, 40 to 50 cartons per minute can be addressed. When all the shipment is addressed, the stencil is thrown away. Filing time and space are saved. For further information on Weber address systems, send the coupon below.

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Send me your bulletin on "Assembly Line" Addressing Systems.

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be equipped with club-type jackets, bearing the legend "Longhairs" and "Neanderthals," respectively. Management now faces a long and difficult period of adjustment.

PROBLEMS AT THE TOP

Now consider the view from the top of the ladder. The problems the specialist creates for top management need only be detailed to be appreciated. Here are four major ones:

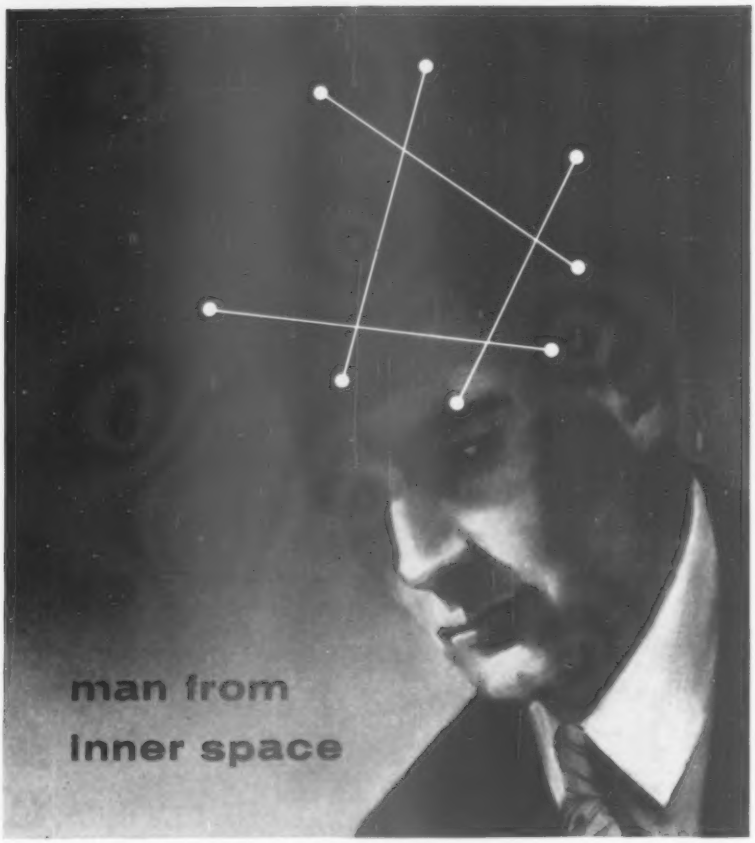
1. Unionization — Management's fear of unionization of its people above the rank-and-file level, largely laid to rest by the Taft-Hartley Act, may rise again. The so-called "professional employees" rather than supervisors would be the targets for union organizing drives.

This tug of loyalties represents a problem of self-interest for the specialist. Thus far he has shied away from non-professional affiliations outside his company. But the tug-of-war threatens to grow stronger. Unions are interested in specialists for two good reasons. One is supplied by the "AFL-CIO News" (Dec. 27, 1958), which states that in the last 10 years professional employees have increased 60%. The other is that a 22% increase in white-collar employees represents a tremendous group, which many union experts feel they can best reach through the specialist.

Management usually doesn't object to the uniting of a company's professional engineers and technicians into a self-contained group. What does give management pause is the possibility that its engineers, in their new importance to company operations, may affiliate with one of the big international unions.

2. Organizational changes—The middle-management level, for example, is in for drastic revamping. One of the basic functions of middle management is that of communications screening. In the old line-staff organization the size and nature of the front-line activity produced a large amount of data that had to be sifted for top management. Similarly, top management needed a communications intermediary between itself and the lowest levels.

Turn to page 236



Outer space has its problems and its specialists. But for those concerned with moving things through the *inner* reaches of a plant or factory, there is no better source than "The Man from Logan."

As your field engineer for Logan Conveyors, he must qualify with a strong academic background, years of home-office and field engineering work, and a good command of Logan's two generations of experience as a leading conveyor company.

In addition to these personal qualifications, "The Man from Logan" calls on any assistance needed from a progressive research and development staff and an eminently qualified home-office engineering force. And, of course, Logan's resources of materials and components are unsurpassed in the industry.

To you, then, "The Man from Logan," comes as the convenient and completely dependable source for the one best custom-designed conveyor system for any need. You need only to call him in. His broad experience further assures you that costs will be kept as low as is feasible. Write or phone today for a visit from "The Man from Logan."

Logan Conveyors

LOGAN CO., 510 CABEL ST., LOUISVILLE 6, KY.

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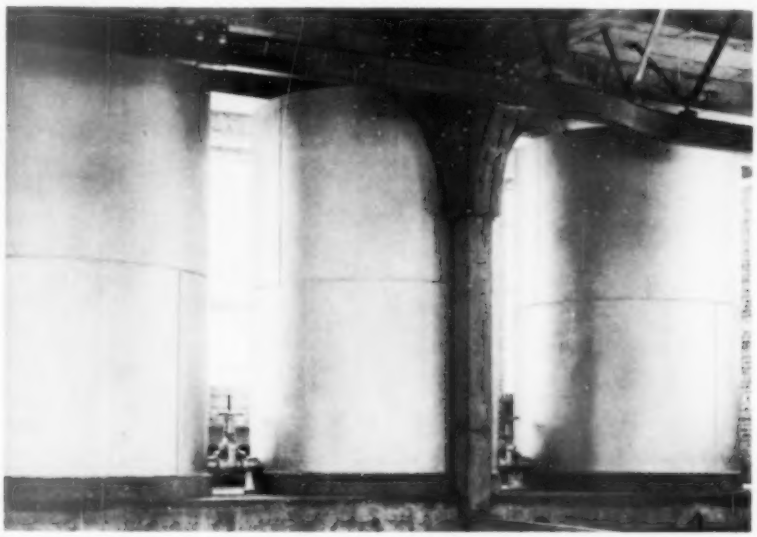
For more facts Circle 588 on Reader Service Card ➤

BYERS GUIDE

Maintenance and Operating Tips from A. M. Byers Company VOL. 1 NO. 4



These welded Wrought Iron tanks, 9' dia. by 12' high, were installed in 1936 in the chlorine storage building at the Coney Island Sewage Disposal Plant, Brooklyn, N. Y. Steam heating coils suspended in the caustic tanks are also Wrought Iron. During all these years, not a nickel's worth of replacement was needed.

4-D Wrought Iron Curbs Corrosive Caustics, Lasts 2-4 Times Longer Than Other Metals

Two types of metal deterioration prevalent in caustic soda handling have been effectively curbed by 4-D Wrought Iron. Let's discuss the nature of this deterioration and consider an economical remedy.

Caustic embrittlement stymied

This is an intergranular type of stress corrosion. Sounds the death knell for many metals. Cracks suddenly develop along the grain boundaries of the metal. There's little or no warning. They occur on exposure to heated caustic solutions, usually in areas where the metal has been stressed.

Crevices where caustic tends to concentrate are also particularly vulnerable to attack. Service reports indicate that 4-D Wrought Iron possesses excellent resistance to this type of corrosion.

Normal corrosion stalemated too

This is a loss-of-metal type of deterioration. You run into this particularly when the metal's exposure to caustic soda is interrupted by periods of exposure to air, water or neutral solutions. Severity of corrosion depends on temperature and concentration. Over 250,000 glasslike iron silicate fibers per cross sectional square inch of 4-D Wrought Iron distributed throughout the highly refined base metal—help halt and diffuse corrosive attack.

Heated, concentrated caustics tougher on most ferrous metals

Heated and/or concentrated caustic solutions become increasingly corrosive to most ferrous metals. It takes a silicate-based metal like 4-D Wrought Iron to combat this type of corrosion effectively. That's why design and maintenance engineers are turning more and more to 4-D Wrought Iron pipe and plate for caustic soda heating tanks and heating piping used in caustic processes. Clip coupon for case history service reports.

In Nuclear Equipment 4-D Does Not Distort Radiation Measurement

Manganese and carbon become excited or "stay alive" in a radioactive environment. 4-D Wrought Iron's *low* manganese and carbon content and *low* total metalloid content enable it to perform mechanical functions in nuclear processes without distorting radiation measurement. Check corresponding box in coupon for more information.

Manganese Wrought Iron Resists Impact When Cold

A new specialty wrought iron has been developed for use as an economical, impact resistant metal for low temperature design.

You can use Mn Wrought Iron in the petroleum, chemical and refrigeration industries and others in which brittle failure is giving trouble. It's available in pipe, plate, other forms. Clip coupon for details.

Lower Tubing Costs

Cold drawn 4-D Wrought Iron heat exchanger and condenser tubing is virtually unaffected by ammonia, carbon dioxide and Freon. 4-D tubing lasts longer than steel in salt water, heat transfer brines, and industrial cooling waters. In most tubing applications, 4-D costs less per foot per year of service than other tubing materials. Check coupon for proof.

A. M. Byers Company
Product Development Department
Clark Building, Pittsburgh 22, Pennsylvania

Please send data on items checked:

- ☐ Caustic Soda Handling
- ☐ Nuclear Process Equipment
- ☐ Mn Wrought Iron
- ☐ Condenser and Heat Exchanger Tubing
- ☐ PVC Pipe for Machine Tool Equipment
- ☐ Colorized Wrought Iron
- ☐ Laboratory Test Results
- ☐ Block Rack Construction

Name ..... Title .....

Company .....

Address .....

BYERS GUIDE

Hex bar fits snugly in feed rack after liner is in place, so that no adhesive bonding agents are necessary.

New Design Idea* Muffles Noisy Machine Clatter

A new idea for muffling the clatter of machine tool equipment while in operation has been developed by A. M. Byers Company.

Recently a patent application* was made for the new idea which involves lining the bar guide or feed rack on automatic screw machines, turret lathes, etc. with PVC Pipe.

Noise is virtually eliminated and nicking or scratching of bar material is impossible. Some manufacturers have found that the metal feed rack can be replaced with PVC entirely on certain equipment such as engine lathes.

The original test installation of PVC Pipe in this application has been going strong for 10 months with no sign of trouble. And the cost of lining or replacing the feed rack with PVC Pipe is phenomenally low. It's less than $5.00 on single feed machines.

For more details on this one, check the coupon and mail to us.

*Patent pending. A. M. Byers Company

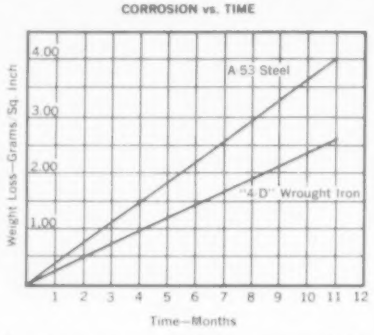
Soot-Blowers Use 4-D To Combat Oxidation

Blowing soot with steam or air tests the temper of the toughest metals. Oxidation is a constant threat, especially to fire tubes. Some metals flunk such hot-again, cool-again tests of endurance. But not 4-D Wrought Iron. 4-D can be furnished *calorized* to resist corrosion at high temperatures (1000—1600°F) prevalent in this service. Fill out coupon for more details.

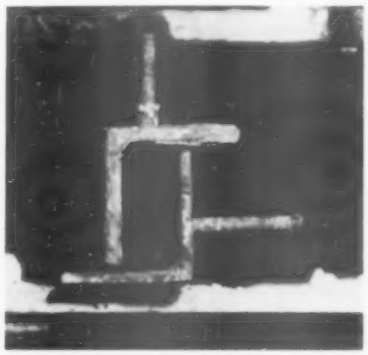
Lower Corrosion Rate For 4-D Wrought Iron

Data for 4-D Wrought Iron and steel plot as virtually straight lines, with 4-D Wrought Iron having a lower slope or rate of attack. Curves will flatten with time.

These data indicate that the 4-D Wrought Iron curve will continue to flatten at a lower rate than the steel curve. Other 4-D Wrought Iron test results are available on request. Please refer to coupon.



Here is a comparative laboratory analysis of corrosion losses in aerated salt water. Tests were conducted by A. M. Byers Company metallurgists.



This unretouched photo shows a comparison of 4-D Wrought Iron and steel after in-service testing at Mercier Brick Company, Dearborn, Michigan. That's 4-D Wrought Iron on top. Steel angle rests directly underneath. Both of these angles were ¼-inch thick when placed in service, side by side on the same rack.

Concrete Block Racks: Which Metal Lasts Longer?

If you guessed 4-D Wrought Iron over steel, you're 100% correct. After 11 months—101 cycles—the 4-D Wrought Iron angle has retained its original thickness. But the steel angle has already lost more than half of its original thickness due to extreme flaking and disintegration from corrosion. 4-D Wrought Iron's resistance to corrosive elements in block production processes is characterized by a hard, impregnable surface shield which cannot be flaked. Even with blows from a hammer. You be the judge. Which metal would *you* use in concrete block rack service? Send coupon for new booklet, "Modern Concrete Block Rack Construction."

For additional information on 4-D Wrought Iron, Contact Byers Division Offices in the cities listed below.

The maintenance and operating items appearing in BYERS GUIDE #4 were prepared by the Engineering Service Department of

A. M. BYERS COMPANY

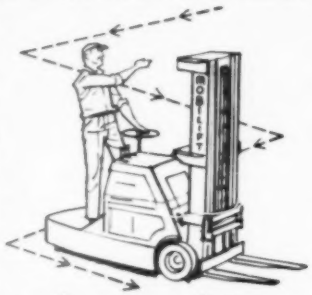
Pittsburgh 22, Pennsylvania

ATLANTA • BOSTON • CHICAGO • HOUSTON • NEW YORK • PHILADELPHIA
PITTSBURGH • ST. LOUIS • SAN FRANCISCO • WASHINGTON, D. C.

4-D Wrought Iron is immediately available and may be obtained through established distributors of Wrought Iron Pipe. Plate, bar, and other flat rolled products may be ordered direct.

Corrosion costs you more than Wrought Iron

Printed in U.S.A.



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and the Mobil-Matic transmission. He will tell you it means day-after-day, easy-to-operate control on both stand-up and sit-down models.

Look us up in the Yellow pages or write today for further details!

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NEW KIRK & BLUM

Dust & Fume Control CATALOG

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See how Kirk & Blum engineers the best suited dust and fume control system for each particular application.

See how Kirk & Blum provides one source for the complete operating system—design, fabrication, installation—*one* undivided responsibility.

Clip and send coupon below for your copy.

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Please send me Dust & Fume Control Catalog.

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paints
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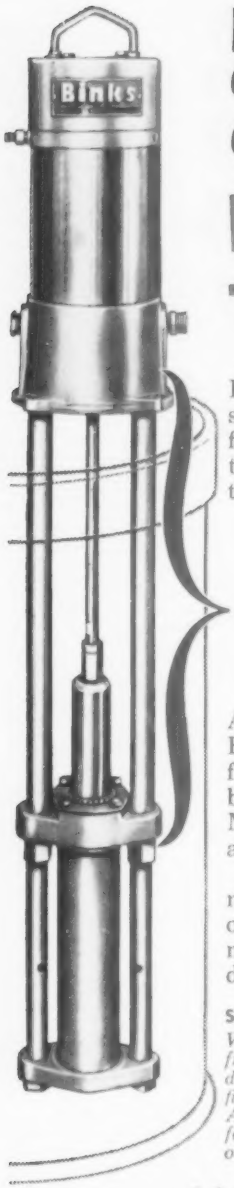

Binks air-operated material handling pumps supply paints, coatings and compounds right from the shipping drum to spray gun. In-between steps are eliminated . . . so are handling time, cost and material waste.

...and Binks SPACE DESIGN pumps wear longer

Additional savings bonuses are built right into Binks pumps. They are SPACE DESIGNED for long, trouble-free service. Plenty of space has been put between the motor and pump piston. Materials just cannot sneak in to damage the air motor and cause excessive wear.

They are easy to maintain, too. Oiling is never needed. The air valve that controls the piston operation easily slips out as a unit for quick maintenance. The pump section can be easily dismantled without special tools.

Send for free bulletins

Whether you need pumps for operating from 5-gallon containers or 55-gallon drums or standpipe installations, you'll find what you need in Binks pump line. Ask your Binks industrial distributor for copies of these fact-packed bulletins or write direct.

Ask about our spray painting school
Open to all...NO TUITION...covers all phases.

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EVERYTHING FOR SPRAY PAINTING

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Begins on page 224

But as front-line operations become more compact in terms of data and simplified in human elements, the communication need is for speed rather than interpretation. In this situation a middle-management level represents an unnecessary element in the communications set-up.

Harold J. Leavitt and Thomas L. Whisler, in an article in the *Harvard Business Review* (Nov.-Dec. 1958) entitled "Management in the 1980's," foresee this: "A radical reorganization of middle-management levels, with certain classes of middle-management jobs moving downward in status and compensation (because they will require less autonomy and skill), while other classes move upward into the top-management group."

In the short range there may be an increasing standardization of operations. In a sense this will take some of the load off middle management. Here's how:

Much of the work of information gathering and interpretation—and communications—will be done by the technical specialties—operations research (O.R.), data processing, and economic, psychological, and social research projects. Even the administrative functions will be standardized. O.R., for example, may take the place of management judgment in programed computers.

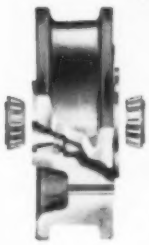
The trend in this direction is already under way. Here's a statement by a top executive of a large chemical and allied products company:

"Until recently we never would have considered moving personnel around much. Men from our chemical division stayed there. People in our textile and plastics divisions stayed put. But now we move people more freely. We even move them from production to staff positions. And staff people have moved into line jobs. Office managers and controllers have moved into production jobs, production people into research and development, and so on."

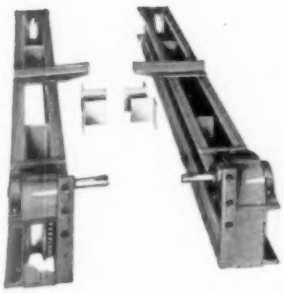
As the middle-management echelon thins out, the decentralization trend will reverse. Many functions will be re-centralized under top-management technical experts.

Interestingly enough, span of con-

It Costs Far Less to Build a Crane Locally from Wright Matched Components!



TREAD WHEELS
Made of special car wheel iron with the tread deep chilled to a hardness of 450-500 Brinell. Tapered tread is self-aligning.



END TRUCKS
Welded steel channel construction with heavy steel plate diaphragms. Squaring shaft of ground and polished steel.

CRANE DRIVE UNIT
Consists of electric motor and well-proportioned gear reduction. Solenoid "drag" brake. Size 1—motors up to 2 HP. Size 2—3 or 5 HP motor.

• Now, buy a dependable WRIGHT B-514 Top Running Single Bridge Crane the modern, money-saving way! Here's all you do! Instead of paying shipping costs on a complete crane, order only the matched components—end trucks, crane drive unit, trolley hoist—from the WRIGHT factory. Then, buy heavy I-beam structurals from a local source. This way you realize big savings by greatly reducing freight charges. In addition, WRIGHT also furnishes you with detailed plans for assembly, including a list of essential structural components to be bought locally.

A FEW OF THE WRIGHT B-514 FEATURES:

Controls • Single-speed push button controls are furnished with fluid-drive models, variable-speed push button controls with models without fluid drive. Variable speed controls have five selective speeds for speeding and slowing crane travel.

Fully Integrated Electrical Controls for the B-514 assembled locally with a WRIGHT Hoist and WRIGHT Crane Drive Unit are factory-installed at no extra charge.

Two Timken Roller Bearings to each wheel. Placed in opposition to one another, they compensate for radial and thrust loads.

Complete information about the WRIGHT B-514 Crane and other WRIGHT products is available by writing our York, Pa., office.

In Canada: **UPTON, BRADEEN & JAMES LTD.,** Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Vancouver

WRIGHT CRANES

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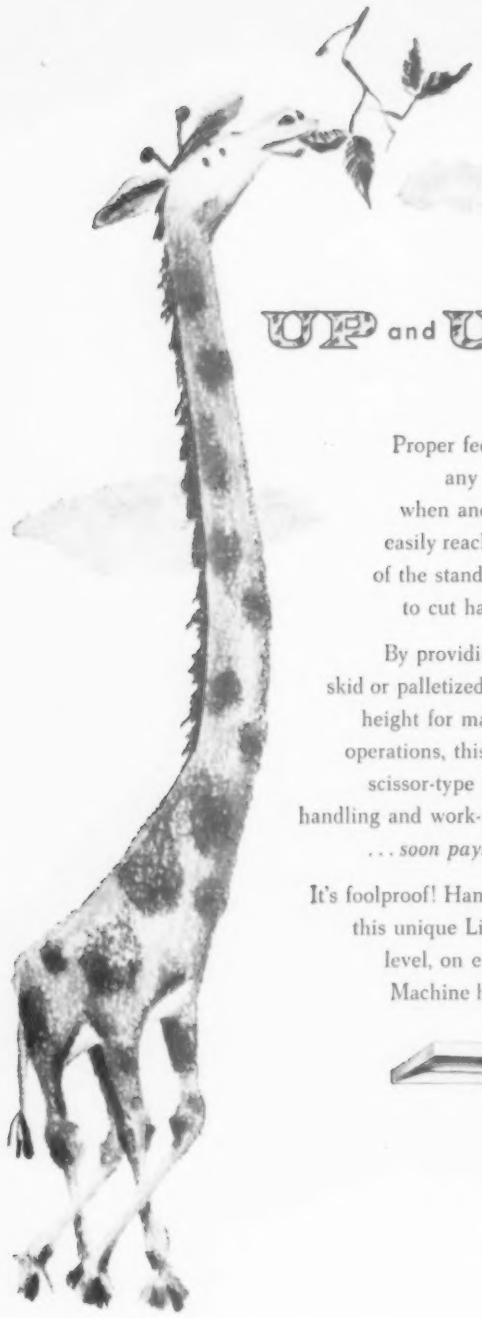
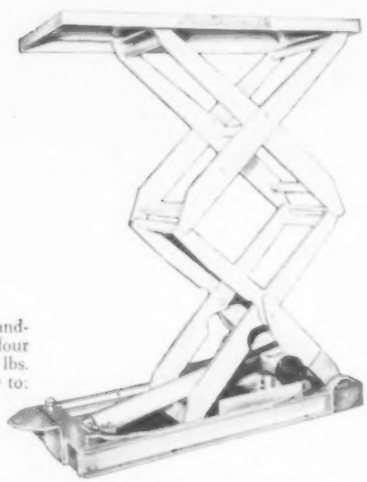


UP and UP and UP

Proper feeding height . . . in fact, any working height you want — when and where you want it — can be easily reached with an adaptation of the standard Southworth Lift Table*, to cut handling costs in *your* plant.

By providing an easy way of elevating skid or palletized loads to correct working height for machine, process, or assembly operations, this hydraulic-powered, scissor-type Lift Table solves feeding, handling and work-positioning problems . . . *soon pays for itself.*

It's foolproof! Hand or foot switch stops this unique Lift Table at any desired level, on either rise or descent. Machine holds position if power fails.



Double scissor-leg Table, adapted from a standard LH model. For further details on our four Series of Lift Tables, capacities from 500 lbs. to 24,000 lbs.; vertical travel to 64", write to:

*PATENT PENDING

SOUTHWORTH MACHINE CO. since 1890

SOUTHWORTH LIFT TABLES

a division of SOUTHWORTH MACHINE CO., 349 Warren Ave., Portland, Me.

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Begins on page 224

trol will broaden. The old rule-of-thumb maximum of six subordinates to an executive will be discarded. The executive-specialist, able to operate to a large extent by Taylor's principle of exception, will be able to direct the efforts of a larger number of subordinates than his less technically trained predecessors.

3. New problems in recruitment —The outstanding rank-and-filer and the successful supervisor have been the traditional manpower source for management jobs. But now the educational and intelligence qualifications for prospective managers have widened the gap. No matter how much common sense or native intelligence a man may have, he cannot cope with highly technical problems. Only extensive education will equip him to understand and deal with the scientific and mathematical dimensions of tomorrow's management problems. With more and more companies in the market for technically trained personnel, an educational system already struggling against odds to meet industry's needs offers only limited promise.

Of course, our scientific and technically trained manpower needs have been in the news for several years. One reason often cited for an intensification of the problem is the low birth rate of the 1930's. Many of the recruits for the lab and drawing board must come from youngsters between the ages of 15 and 24. Here are figures (in millions) on the available supply:

	1940	1950	1960
Age 15-19	12.3	10.7	13.4
Age 20-24	11.6	11.5	11.2

The figures indicate a shrinking base pool in the face of an increasing demand. This doesn't mean fewer young people in universities. On the contrary, in the next 10 years the college population should double—if facilities can be expanded to handle the increase.

But how is this expansion to come about? Is the answer federal aid to education? Or direct business and industry aid to local educational institutions? Many companies can't wait for the answer. They may have to act—make cash investments (in the form of scholarships or endowments) that will increase their

PowerGrip "TIMING" BELTS

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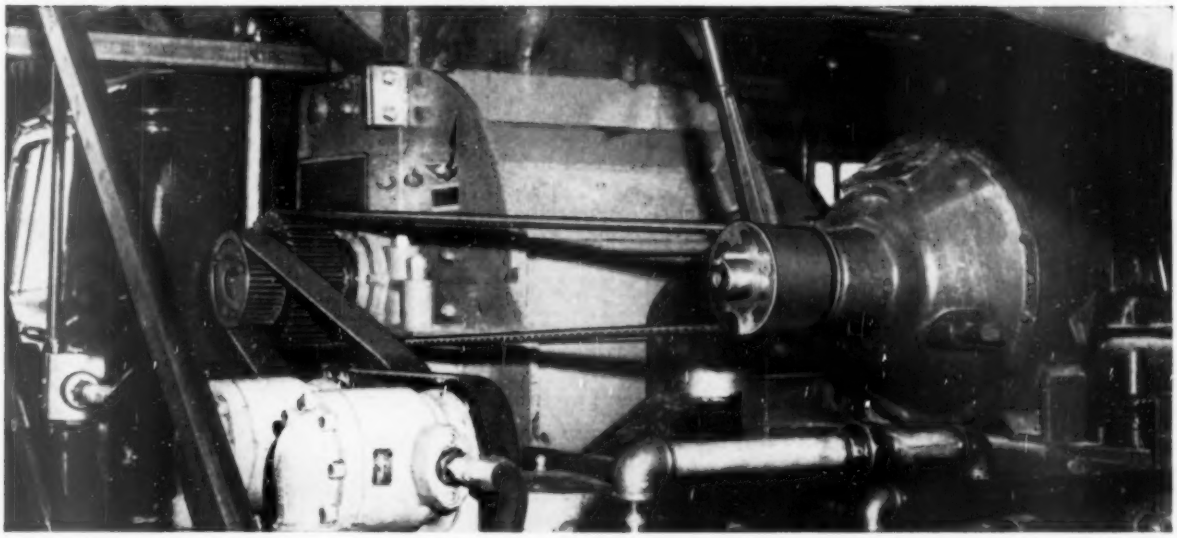
ONLY U. S. POWERGRIP "TIMING" BELTS WOULD DO!



When a mining company started to isolate minerals from a 200,000-ton pile of mine tailings in New Mexico, they used 2 mobile rigs each equipped with a conveyor. Power transmission turned out to be the worst headache. Space was narrow, power needs high, belt speeds extreme. But U. S. PowerGrip "Timing"® Belt met all the needs:

Installed on engine driving crusher and hydraulic pump, U. S. PowerGrip handles speeds no roller chain could handle. A chain drive always involves lubrication problems. V-Belts would need larger pulleys, which would place belt speed outside of V-belt range. Jackshafts and several bearings would have been needed for any other transmission medium, with resultant expense and space consumption. PowerGrip abolished these problems.

With PowerGrip, the company was able to keep belt speeds up to 7,000 feet per minute.

• PowerGrip has no slippage, no take-up • Absence of metal-to-metal contact eliminates need for lubrication and housing • Handles speeds up to 16,000 f.p.m. • Close to 100% efficiency.

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FACTORY

chances of getting specialists with the training they need.

4. Changes in thinking—Top managers won't escape unscathed from the advent of the specialist and all he represents. Maybe that highly desirable executive who came up through the ranks rather than from the technical side of the business will have to go back to school to understand what his company is doing production-wise. With the specialist as a working member, he will have to learn to communicate in terms that will be understood.

The outlook seems to call for education of two kinds: technical training for the executive and managerial training for the specialist.

PROBLEMS FOR SPECIALISTS

The specialist is not only a cause but also a victim of the situation created by his entrance into the work scene. Here are four kinds of problems he faces—and some suggestions that may help him:

1. Resentment and resistance. Often a growing company hires a specialist to take over a given responsibility. Company officers then sit back with the feeling, "Now that's taken care of."

But to the specialist the first weeks and months on the job are likely to be nightmarish. A situation that developed in a paper company that had just hired a safety engineer has been duplicated in practically every industry across the board, and with specialists in a broad range of centralized functions.

The paper company, faced with a mounting lost-time accident rate, put a safety engineer in charge. Thereupon accident rates soared to new highs. Front-line foremen were interviewed. They showed an appalling lack of concern. A maintenance foreman, whose record was the worst in the company's entire experience, said, "Safety? That's not my job any more." A coating-department foreman said, "That's the safety engineer's job."

What each expressed was resentment against the specialists, flavored with this feeling: "He'll get the credit, so let him work for it."

Resentment and resistance go

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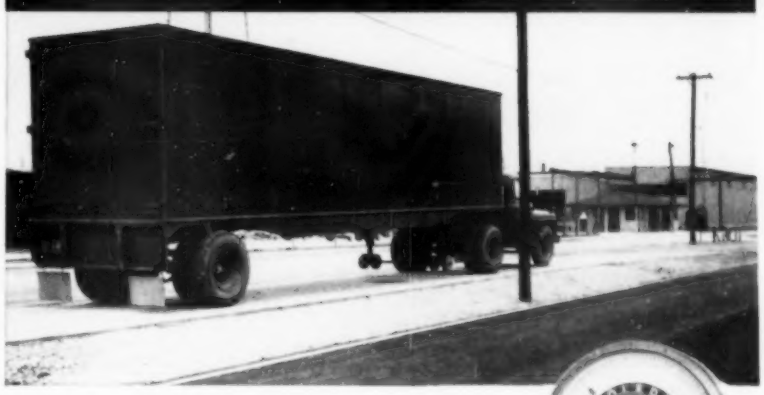

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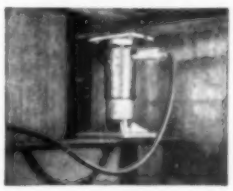

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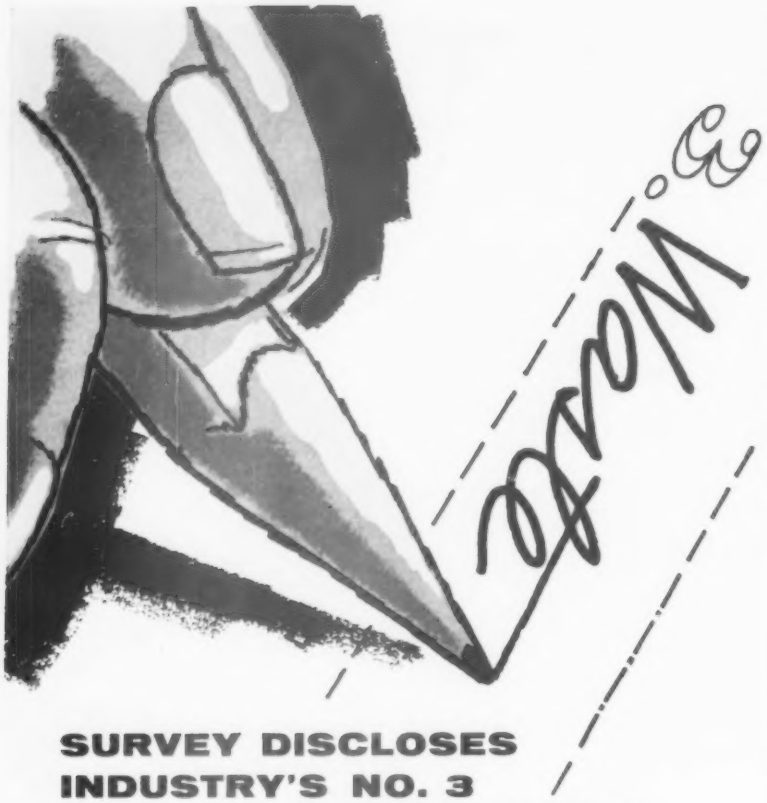

SURVEY DISCLOSES INDUSTRY'S NO. 3 SKIN HYGIENE PROBLEM: WASTE SOAP

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3. *WASTE OF SOAPS*

Closely associated with the actual problem of skin disease is the costly waste of soaps in *all* plant areas. Liquid soaps run off hands too easily, other types melt or spill. Where wasted soap accumulates, extra housekeeping expenses are involved, sub-sanitary conditions exist and worker dissatisfaction mounts. Often the combined cost of soap waste and resulting maintenance can add up to more than the original cost of the soap supply. Small wonder industry rates it as such a problem!

What's the answer to it? Ask an SBS representative to show you "Operation Pinpoint", 10 minute sound slide digest of the national survey, and you'll see how a *planned corrective program* can solve all these skin hygiene problems. Since SBS produces a *complete range of cleansers*, he can suggest the right cleanser for each job. For the safest, savingest answer to skin disease, tough soils, and soap waste, write today . . . Dept. 11.

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hand in hand with change. The symptoms fall into three categories:

• Personal. The supervisor, or other employee who feels his job responsibility is being infringed upon, will resist. He may simply withhold cooperation, as in the paper company case, or express himself in outright disparagement of the expert's abilities. Often the criticism is put in terms of the specialist's practical inexperience.

• Procedural. Often the specialist brings with him a new system of procedures and methods. These may involve forms, records, and so on, which must be installed over and above current operating practices. Men faced with the need to change their own method of operation are likely to create stumbling blocks that cripple the new system.

• Organizational. Lack of clear company policy and failure to define responsibility are likely to cause friction. Even where top management's intentions and efforts are good, there's still room for honest confusion when a new authority or function is added.

In addition to top management's efforts to clear the way for the incoming specialist, the newcomer must put forth efforts of his own. At the very least he should learn to expect difficulties and be prepared to minimize them.

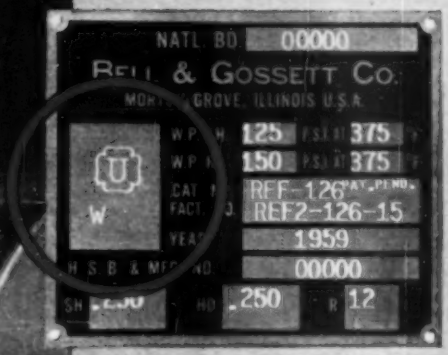
An awareness that he is likely to be treading on toes should not cramp his style, but is an argument for attempting to get the cooperation of the people with whom he comes in contact. Asking for their ideas is likely to produce valuable information. Also it may correct the impression that he, the specialist, is unmindful of the experience and status of his colleagues.

2. Place in the sun. A lot of the difficulty that confronts the specialist is similar to the situation a craftsman complains about when he says, "You can't put new to old."

As a new fixture to be grafted onto an established system, the specialist raises the problem of just where and how he should be appended. There are various possibilities, each with a certain amount of logic, each with obvious objections.

Turn the page

SYMBOL OF QUALITY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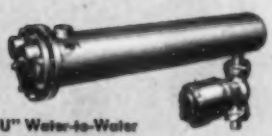

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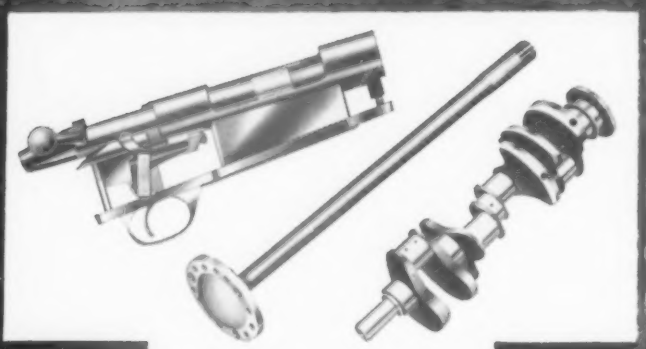

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TODAY'S PLANT SPECIALIST
Begins on page 224

(Some are illustrated by doodles, in color, on pages 224-25.)

- The specialist can be put into the line of direct authority. But he may be a poor manager outside of his speciality.
- He can be in a staff advisory capacity. But that puts a burden on the manager to whom he reports.
- He can report directly to the line manager in charge of his function. But chances are he'll have trouble getting new schemes past his boss if the boss is the least bit backward—or even cautious of things he can't readily understand.
- The line manager and the specialist may share responsibility for the function. But it takes mighty big men to make this work out as well in practice as on paper.
- It may be possible to train managers as specialists; or *vice versa*.

The factors determining which possibility is feasible are these:

The work itself.
The qualifications of both men.
The personalities of both men.

Shared responsibility may be best when both individuals can work side by side, in fairly well differentiated functions, and where communications among the three can be worked out satisfactorily.

3. Becoming a manager. Maybe the solution for the specialist having conflicts of function and status with technically untrained colleagues is for him to take over both the management and technician's job. The fact that it's a problem of long standing, which many specialists have already mastered, doesn't hide the fact that many also have failed.

Granted, technically unequipped managers have acquired the technical training that gave them a specialist's rating. And many specialists have succeeded in absorbing the management and human relations skills needed to survive and prosper in management. Yet many specialists fight the pressures pushing them in the direction of what often seems mere administrative routine and organizational dealings with people.

Even the pure scientist usually finds that the requirements of his activity demand that, as a member of a team effort, he develop the abilities, quite apart from his techni-

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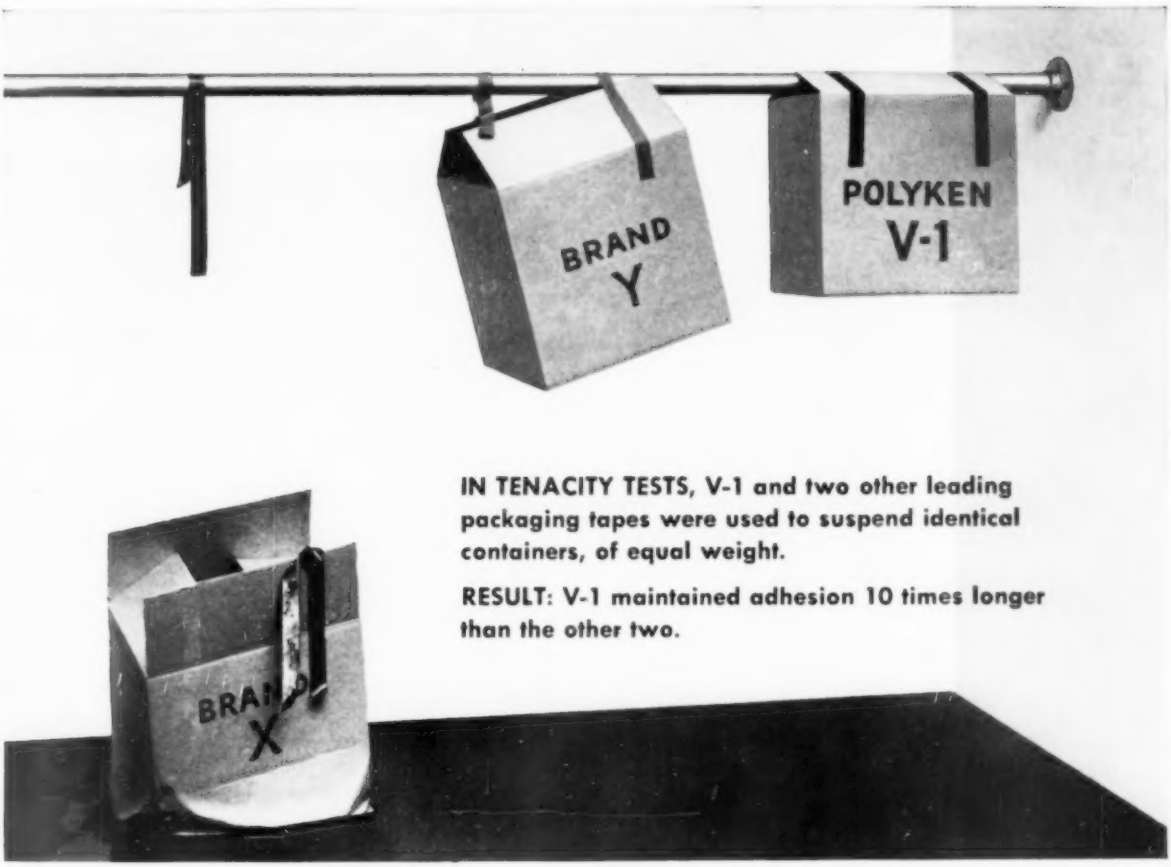

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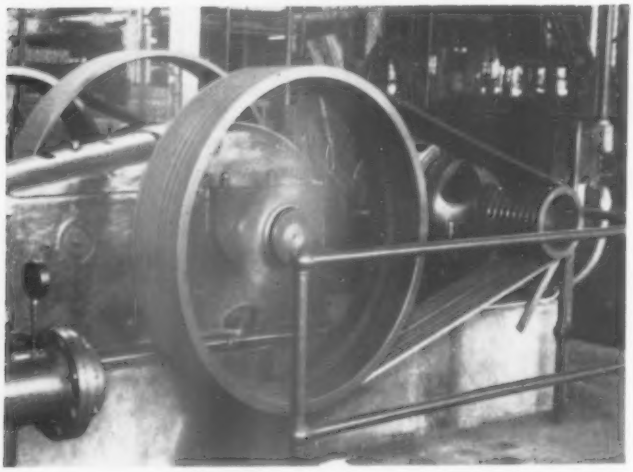

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cal training, required to work effectively with others.

An earlier and easier acceptance by the specialist of the realities of his working situation may simplify his company orientation. Willingness to master the intricacies of management may convert a frustrated specialist into an effective technical administrator or executive.

4. Obsolescence of skills. Many an expert, riding high when his speciality was in demand, has found he's out on a limb as a result of a sudden change in technical processes. For example, the electronics engineer who was right on the ball in the vacuum tube era can find himself out in the cold when his company goes in for transistors.

The remedy is not an avoidance of specialization, but rather one or both of these activities:

- Keeping up with the trends. The specialist who fails to keep up with developments in his field cannot compete with his colleagues who do.
- Keeping one foot on base. To avoid being tagged out, the specialist must keep in touch with the major areas of his competence. This way, he'll keep the lines open for retracing steps and entering an allied field of specialization.

Innovation of any kind means change. Postwar technological advances, giving way to an even faster rate of development since Korea, will continue to change the landscape. With the stepped-up economic competition from the Soviet Union and the emergence of Red China as an industrial power, pressures from outside our national boundaries will be added to internal pressures to steadily increase our rate of technological change.

For many companies this means the appearance and proliferation of specialists—as individuals to be absorbed into existing organizational structures, and in groups needed to man new technical departments.

Only by the continuing awareness of management—and of the specialist himself—to the problems and opportunities his advent brings about can the changes in organization and in personal working relationships be accomplished with minimum friction and optimum efficiency. **END**

Free Booklet by Scott's Washroom Advisory Service shows how to provide cheerful, efficient washrooms that cost less to maintain

Ladies' lounge at Mutual Trust, as designed by Perkins & Will, reflects suggestions from Scott's Washroom Advisory Service—mirrors located away from washbowls prevent hair-clogged drains; lipstick dabs (note holder mounted on mirror) save paper towel expense.

Mr. Maurice G. Wahlstrom, Building Superintendent of Mutual Trust Life Insurance Company's new home office in Chicago, says: "Our washroom facilities reflect management's consideration for employees and help to make daily working life enjoyable instead of a drudgery."

PERKINS & WILL, ARCHITECTS

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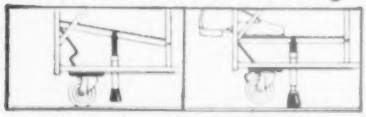

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FACTORY ... BOOKS

Here's Help for Your Supervisors

This old master hasn't lost his touch. In *Foremen in Action*, Glenn Gardiner displays a sure feel for the foreman's problem and a certain ear for the foreman's language. It's gratifying that after so long a time one of the pioneers of industrial training has brought forth such an immensely helpful work.

Glenn has written more books about supervision and the training of foremen than anyone we know. It could well be that *Foremen in Action* is his best. Why? Because he uses with great facility a new technique that makes this work especially readable. Knowing that foremen don't take easily to the written word, Glenn has avoided a textbook approach. He has written the book as a series of narratives about 12 foremen. Each narrative is a study in depth of a foreman facing up to a basic phase of supervision. This technique makes the text, the situation, and the advice come to life. And while it causes the author to idealize occasionally, in the long run he is wonderfully realistic.

Of special interest to training directors and others responsible for supervisory development is a major section of the book called "Action Plans for Better Foremanship." This section provides a series of self-help and study guides for foremen and instructors. First it includes specific review questions for each "career study." Next it provides a number of related situations to be discussed, which are followed by a couple-of-dozen questions for group discussion. And, finally, there is a comprehensive supervisors' self-inventory checklist.

Chapters cover such basic subjects as: developing the workforce, decision making, handling change, communications, job methods, job training, discipline, grievances, dealing with union stewards, safety, and human relations.

Operating managers remember Glenn Gardiner well. A former vice-president of the Forstmann Woolen Company, Glenn was the director of Training-Within-Industry for the State of New Jersey and a member of the War Manpower Council. In these capacities, he developed the famous J.I.T. program. At present Glenn is vice-president of the Elliot Service Company and editor of *Management Information*.

Foremen in Action is a book you'll want to add to your personal library. It's one that will be especially useful in preparing men for foremanship and in developing supervisors in a training program.

Foremen in Action, by Glenn L. Gardiner. Harper & Brothers, 49 East 33rd St., New York 16. 238 pages. $4.50.

How to Better Employee Magazines

Company magazines and publications can be management's strongest communications tool. But in many cases they're not. A new operations manual (from The Bureau of National Affairs), *Effective Communication in Company Publications*, can help you change this situation. It brings together the experience of over a hundred editors and industrial communication specialists in a "how-others-have-done-it" and "how-you-can-do-it" book.

There are 51 case histories of resourceful and successful employee communication methods used by more than 40 companies of all sizes and in all industries. Some are brief examples. Others are detailed with illustrations of actual pages from company magazines. Subjects of the case studies range from technical aspects of editing and printing to methods of handling controversial issues such as strikes, political campaigns, and layoffs.

But the book offers more than case histories. The author, C. J. Dover (now a consultant on communications at General Electric Company), draws on his 15 years of experience to make this a comprehensive course in employee magazine editing. You'll find it helpful

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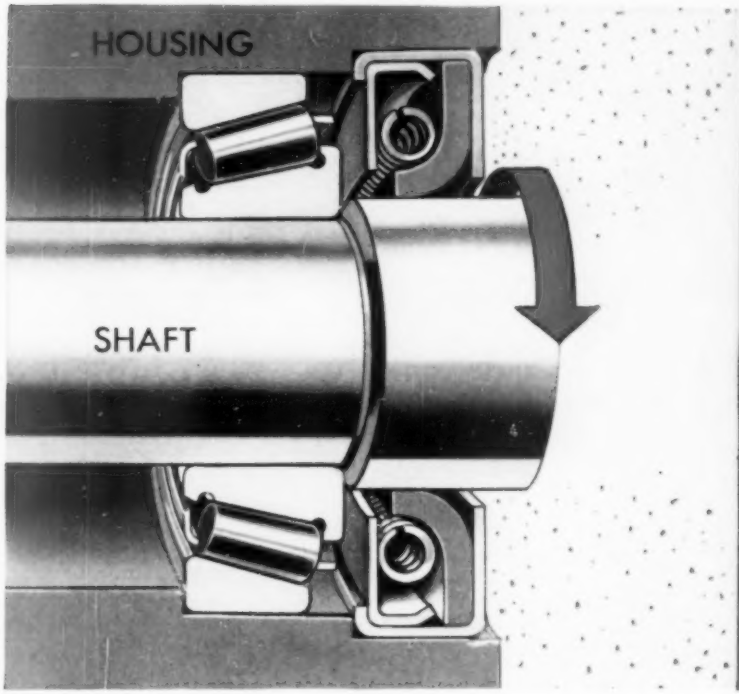

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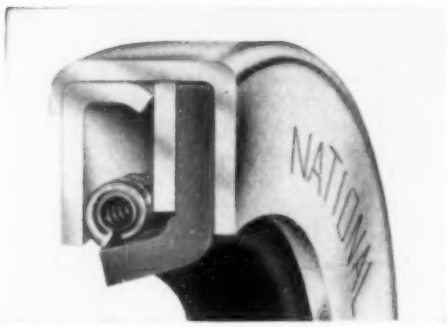


National Oil Seals feature: 1. *Micro-Torc* leather that seals in oil and grease, has untreated side to absorb lubricant; 2. *Syntech* synthetics "prescription-blended" to meet specific operating conditions.

National Micro-Torc and Syntech oil seals—in any standard size or made to order—protect big investments at low cost

Count on National Oil Seals to guard your costly machines! They seal *in* the lubricant so vital to precision bearings; seal *out* abrasive dirt and corrosive moisture so harmful to bearings and other machine components—and there's one for *any* job.

National Micro-Torc leather is impregnated only part-way through. The coated side seals perfectly; the untreated, porous side absorbs the lubricant leather needs to stay flexible, run cooler and longer. **National Syntech synthetics** are "prescription-blended" to meet the most exacting conditions of temperatures, shaft speeds and other critical factors. Both types come in all sizes.

In leather *or* synthetic, National industrial oil seals protect your capital investment at low cost. So why take a chance on a used seal? Call your National Seal specialist for replacements!

NATIONAL OIL SEALS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

NATIONAL OIL SEALS

For more facts Circle 604 on Reader Service Card

FOR

GREATER

"SMALL-TUBE"

reliability

...replace with RCA "Premiums" and "Special Red" Tubes

Recommended wherever increased reliability of small-tube circuitry is important. Characteristics are uniform throughout useful life. Rigid controls and rigorous tests weed out "early failures". Designed and built to give dependable performance under conditions of shock and vibration. Available at RCA Industrial Tube Distributors.

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N.J.

Handy data book RIT-104-A includes the tube characteristics you need to know when you install RCA "Premium" and "Special Red" Tubes. Free, from your RCA Industrial Tube Distributor.

For the name of your nearest RCA Industrial Tube Distributor, call Western Union by telephone and ask for Operator 25.

as an editor or as a plant executive who wants to improve employee relations.

Effective Communication in Company Publications, by C. J. Dover. BNA Incorporated, 1231 24th St., N.W., Washington 7, D. C. 365 pages, $14.75.

Reds in Unions

This book analyzes Communist attempts to infiltrate the American labor movement. It documents the way Communists captured unions in the motion picture, maritime, and electrical manufacturing industries. Tells how they were fought and exposed by trade unionists, un-American activities committees, and others. It's not an easy story to read—or a pleasant one. But it's one management should be familiar with.

Communism in American Unions, by David J. Saposs. McGraw-Hill Book Co., 330 West 42nd St., New York 36. 304 pages. $7.50.

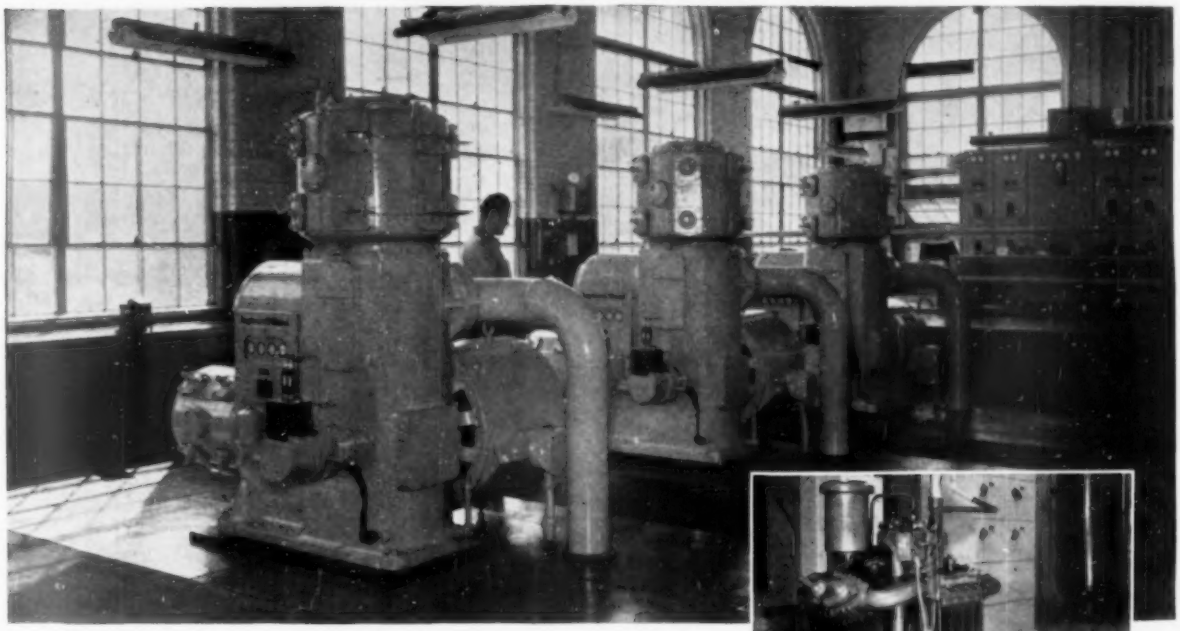
* * *

Psychology in Business. It's a straightforward, non-technical discussion of basic psychology applied to business. Examines intelligence, learning, motivation, personality development, other factors. *By Leslie Beach and Elon L. Clark. McGraw-Hill Book Co., 330 West 42nd St., New York 36. 313 pages. $5.75.*

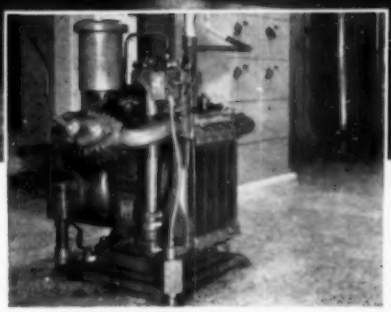
Personnel Principles and Policies. A solid reference text for anyone needing quick, basic information on the management of people. This second revised edition includes chapters on management development, job evaluation, wage and salary administration. *By Dale Yoder. Prentice-Hall, Inc., Englewood Cliffs, N. J. 599 pages. $9.25.*

What the Businessman Should Know About the Taft-Hartley Act. This booklet makes Taft-Hartley downright interesting. It's done through imaginary situations at a fictitious firm. Most managers will find it funny but informative. *By T. J. McDermott. Public Affairs Press, 419 New Jersey Ave., S. E., Washington 3. 32 pages. $1.*

How to squeeze more profits out of your COMPRESSED AIR POWER



Three 125-hp XLE compressors generating air power for a weapons plant. This compact two-stage unit features pipeless Thru-Frame air flow and full-floating aluminum bearings which never need adjustment. Sizes 125 to 350 hp. (Other I-R air compressors to 4000 hp.)



This air-cooled two-stage Type 40 compressor is one of several furnishing plant air and instrument air in a power plant. Sizes 25 to 125 hp. (Others from ½ hp.)

Make sure you have enough pressure at point of use—and extra dependability at point of generation

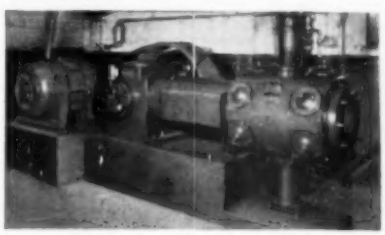
Cost-conscious plant engineers and production men know that to get the full savings inherent with air-powered equipment, you must have full air pressure at every tool.

But it's equally important to guard against unscheduled shutdowns where your air power is generated. This problem can best be solved at the time of purchase, by specifying compressors that have an extra margin of safety against mechanical troubles.

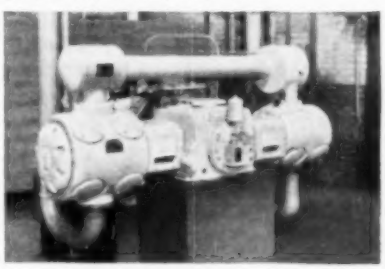
Ingersoll-Rand compressors have that extra safety margin built in. They'll stay on the job longer, with minimum attention and maintenance. Take valves, for example—the most "vulnerable" point in any compressor. Only I-R compressors have Channel Valves, known the world over for efficiency, quiet operation and long life. Their exclusive air-cushioned action eliminates impact and greatly reduces wear.

Also in I-R compressors, all running parts are sealed against dust and dirt which might cause wear. The seal need never be broken, since bearings are a type which will never need adjustment.

For top compressor performance and long-run economy, specify Ingersoll-Rand. And ask your I-R representative to show you how to get your maximum *"Dividend on Payroll Dollars"* with a Planned Annual Review of your air power system.



Ingersoll-Rand's new ESH horizontal compressor, here in a tool factory. Sizes 20 to 150 hp. Also built as vertical unit, called ESV.



Two-stage balanced-opposed PHE compressor handling air in a gas plant. Also built as L-design unit with packaged intercooler. Sizes 75 and 100 hp.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

COMPRESSORS · GAS & DIESEL ENGINES · PUMPS · AIR & ELECTRIC TOOLS · CONDENSERS · VACUUM EQUIPMENT · ROCK DRILLS

5172-GS-B set

(¼ to 1¼-inch wrench size range)

Service factory machinery, engines, cars, trucks, plant utilities and material handling equipment with this handy set of *Snap-on* tools.

Space-saving compactness puts 172 tools in one portable, "quick-select" chest. Sturdily built from welded, heavy-gauge steel, the chest is easily transported from tool crib to job, from plant to field service — wherever it's needed.

The kit is complete enough to handle practically all of your general service requirements. And top-quality *Snap-on* tools fit better, last longer — cost you less in the long run.

We can also help solve your maintenance and service problems with specially tailored sets to meet your needs. Call the nearest *Snap-on* branch for more information — or write direct.

NEW SAFETY FILM

A new *Snap-on* tool safety film is now available for showing in your plant. Write us and schedule it for mechanics and safety supervisors soon.

SNAP-ON TOOLS
CORPORATION
8044-I 28th Avenue • Kenosha, Wisconsin

FACTORY FILMS

An Atmosphere for Productivity demonstrates production step-up and other benefits resulting from air conditioning. Reveals facts on relationship of temperature and humidity to human efficiency. 16mm, sound, color, 23 min. For loan or purchase, write:

York Division, Borg-Warner Corp., York, Pa.

Compressed Air Power explains the principles of different types of compressors and ways of applying compressed air power. Compression and air movement in various types of equipment are shown by use of changing colors. 16mm, sound, color, 17 min. For loan, write:

Modern Talking Picture Service, Inc., 3 E. 54th St., New York 22.

Building for Safety tells how studies are made of fire hazards of building materials. Shows floors, walls, ceilings, roofs, and doors being tested in large furnaces to see how they will withstand fire. Flame spread of building insulation is measured in special tunnel furnace. 16mm, sound, color, 13½ min. For loan, write:

Underwriters' Laboratories, Inc., 161 Sixth Ave., New York 13.

Member of the Family depicts the development and manufacture of a car from its beginnings up to the point it is ready for introduction to the public. Shows how parts are made to the closest tolerances. 16mm, sound, color, 17 min. For loan, write:

Buick Motor Div., General Motors Corp., Flint 2, Mich.

Catalog of Business and Professional Films is a list of 23 specialized industrial films available for free loan. Almost all are in color. For free copy of catalog, write:

Modern Talking Picture Service, Inc., 3 E. 54th St., New York 22.

Fire Control Film List, compiled by the editors of *Firemen*, describes more than 22 films on fire protection and control in every field. For copy of list (50 cents), write:

National Fire Protection Assn., 60 Batterymarch St., Boston 10.

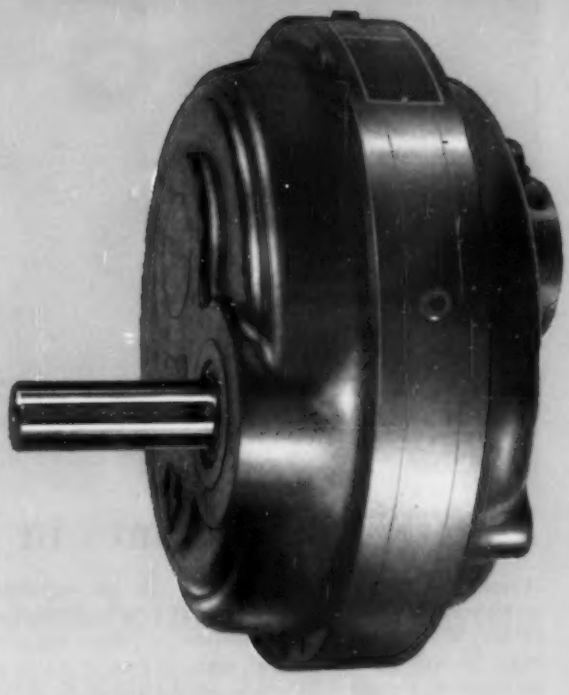
For more facts Circle 608 on Reader Service Card

For more facts Circle 609 on Reader Service Card ➤

World's Most Complete Line of Popular Shaft-Mounted Reducers

The Original and Exclusive "Concentric" Shaft-King

The first shaft-mounted reducer on the market . . . proved on over 150,000 installations. Exclusive concentric design permits foolproof torque-arm overload release. Taper-bushed hub makes mounting easy.

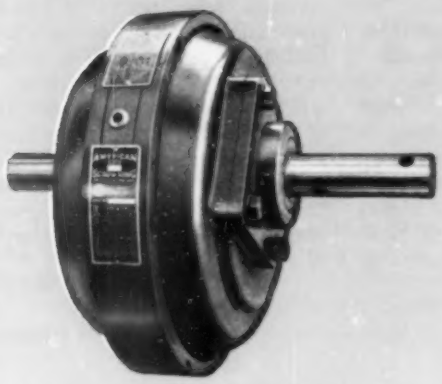


The New "Offset" Shaft-King

Same basic design, engineering and quality that has been proven in the original concentric American Shaft-King, but with input and output hubs offset, permitting easy belt take-up. Taper-bushed hub.

Compact, Easy-to-install Screw-King

The same time-proven design but with extended output hub and dual purpose dust seal. Bolts directly on trough end of screw conveyor eliminating wobble.



Standardize on American Shaft-King Reducers—they're proven, versatile and trouble-free—in 5:1, 13:1 and 20:1 ratios. Call your American Distributor—he has them in stock for you.

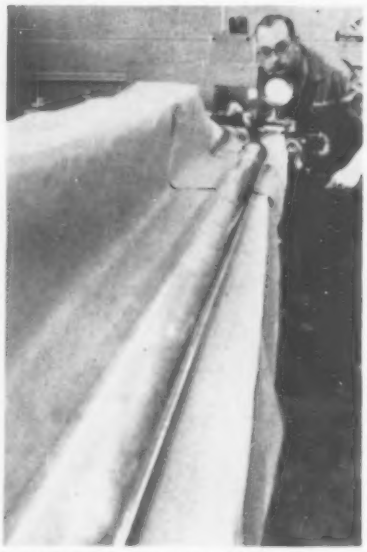
POWER TRANSMISSION DIVISION

THE AMERICAN PULLEY COMPANY

4200 WISSAHICKON AVENUE · PHILADELPHIA 29, PA.

For more about these items, circle numbers on Reader Service Card next to back cover.

FROM 800-FT. OF TUBING . . .



TO 3000-FT. INFLATABLE PIPE

Metal Tubing Comes in Ribbons

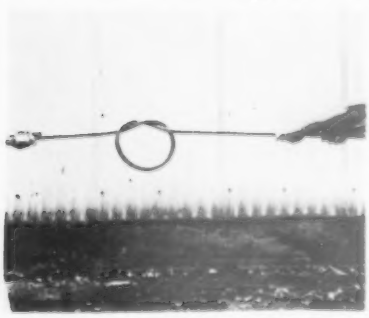
A new seamless metal tubing comes in ribbon form, is inflated at point of use. Called Strubing (strip tubing), it will go into experimental production shortly. Promises important savings in such fields as construction, electrical, communications, packaging, chemical, and general manufacturing.

The new tubing has two major advantages: Since it is inflated at its final destination, shipping costs are reduced. Only the tube "walls" are shipped, no air. And the manufacturing process (cold rolling) used is an economical method of producing thin-wall tubing.

Sizes range from smaller than the lead in a pencil to large enough for a man to walk through. Walls can be as thin as foil or as thick as conventional pipe. Coil lengths up to 15,000 ft. can be shipped. Depending on its use, the tubing can be made of various metals.

In tests, hydraulic pressure, air pressure, mechanical means, or just tap water pressure have turned the "ribbon" into a hollow tube. *Calumet & Hecla, Inc.* (Circle 251).

Flexible Tubing for Heat-Exchanger Use



Welded steel tubing has been designed especially for heat-exchanger use. Tubing is called "Lectrosonic." It can be tied in a knot without damage—though you may not want to use it this way. The tubing is formed from flat metal "strip" with the edges joined by electric resistance welding. New product is said to show savings from 10 to 32% over seamless tubing. *Babcock & Wilcox Co.* (Circle 252).

253—Porous Nickel, pressed and sintered, capable of operating at temperatures to 575 F., is being produced in large and intricate shapes. Called Cormet A, material is processed into sheets 12x30 in., and in cylinders 2 ft., 12 in. in diameter. *Corning Glass Works.*

254—Cushioning Material that's also a package wrap absorbs motion, shock, and vibration. This plastic material, Zylex 6, has 1000 "raised cylinders" per sq. ft.—each acts as independent spring cushioning at all points of contact. *Preservation Packaging, Inc.*

255—Sani-Dust is a new product that sanitizes floors, walls, and equipment within 15 min. after treatment. Applied as dust control chemical to cleaning cloths and mops; used on wood, tile, metal, or plastic composition floors, shelving, desks. *Talb Industries, Inc.*

Free-Cutting Rod

Free-cutting brass rod that's new offers to users of high-speed screw machines closer tolerances in off-the-shelf length and straightness. In addition, new control of chamfer gives additional protection against feed finger breakage. The straightness of "3 Mark Rod" results in quieter operation with less vibration of the machine. It also offers ease of machining, high scrap value, long tool life. Product comes in round, hexagonal, octagonal, and square shapes. *Chase Brass & Copper Co.* (Circle 256).

Turn the page

Thomas S. San Giacomo, president of Cornwall Paper, Orange, N. J., says:

"Paper mill atmospheres are tough on coatings but Bitumastic No. 50 can really take it."

Seven years ago, Cornwall Paper Mills Corporation's corrugated board and chipboard plant at Cornwall, N. Y. had a corrosion problem common to paper mills: processing fumes in a highly humid atmosphere that quickly attacked ordinary coatings on steelwork and processing tanks.

Then Cornwall switched to Bitumastic No. 50, the Bitumastic coating with 20-25 mils dry-film thickness per coat, in an effort to prolong periods between re-coating. As Mr. San Giacomo says, "Bitumastic No. 50 has given us excellent service. Interior structural members, tanks, piping and a large water tank were given two coats. Our Bitumastic coating system is still in fine condition after 7 years and no re-coating is needed."

Cornwall has ordered the same heavy-duty protection of Bitumastic No. 50 for all metal surfaces in its plant addition, presently underway, which will increase the firm's capacity 25%.

Your corrosion problem may not be the same as a paper mill's . . . but the protection and long-life offered by coal-tar based Bitumastic coatings can save you expensive painting maintenance, too. There's a coating in the Bitumastic line for every industrial application. Call your nearby Bitumastic distributor for further information, or return the coupon. Koppers Company, Inc., Tar Products Division, Pittsburgh 19, Pennsylvania. District Offices: Boston, Chicago, Los Angeles, Pittsburgh, New York and Woodward (Birmingham), Ala. In Canada: Koppers Products, Ltd., Toronto, Ont.

KOPPERS

KOPPERS
BITUMASTIC
COATINGS AND ENAMELS
another fine product of COAL TAR

Koppers Company, Inc., Tar Products Division
Dept. 135J Pittsburgh 19, Pa.

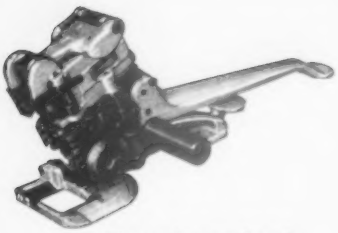
Gentlemen:
Yes, I'd like to know more about Bitumastic Coatings for Corrosion Prevention.

Name_____ Title_____

Firm_____

Address_____

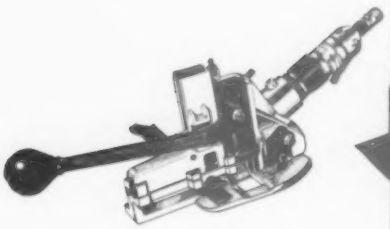
City_____ Zone____ State_____



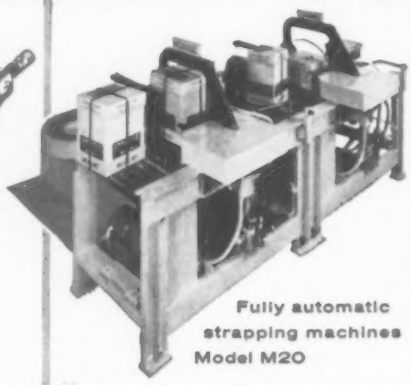
The only one-hand strapping tools SFC Series

Power strap feeders Model PSF

Complete line of air power tensioners PN Series



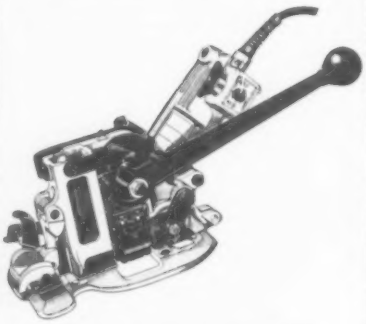
Air power portable strapping machines AP Series



Fully automatic strapping machines Model M20

The first air power feed wheel tensioner for heavy duty strapping FN Series

First compression strapping machines with built-in turntable for 2-way strapping. CSF Series



Electric portable strapping machines. AE Series

N Series

Heavy-duty air power sealers

9 ways to new savings

Binding things together with steel strapping is a low cost way to eliminate individual handlings, save space, and prevent damage. These nine machines—part of the most complete line of equipment in the steel strapping industry—create new ways to save with strapping. Signode will be glad to help you select the right equipment and devise methods to make the most of it. There's a Signode man near you. Call him today, or write:

First in steel strapping

SIGNODE STEEL STRAPPING CO.

2663 N. Western Avenue, Chicago 47, Illinois

Offices Coast to Coast. Foreign Subsidiaries and Distributors World-Wide
In Canada: Canadian Steel Strapping Co., Ltd., Montreal • Toronto

For more facts Circle 611 on Reader Service Card

For more about these items, circle numbers on Reader Service Card next to back cover.

257—Molybdenum Metal Sheet is said to literally "take the heat off" in metalworking, thus simplifies many of the processes where it is now used. This high-ductility sheet can be bent at right angles or double upon itself at room temperature. *General Electric Co.*

258—Metal Finishing Goblet Buff is made of springy, dense wool fibers mounted on a solid 4-in. minimum to 8-in. maximum diameter half-sphere core. Material is tough and enduring, with gentle surfacing action. Uses liquid or solid compounds. *The Schlegel Mfg. Co.*

259—Flooring Material provides a fast-setting, highly abrasive, nonslip surface for highway or factory use. Seeded Emeri-Epox bonds well to concrete, asphalt, wood, tile, stone, brick, and metal surfaces. Two grades—fine and coarse. *Walter Maguire Co., Inc.*

260—Solder Balls have been designed for automatic feeding production processes. Ball-shaped, the forms can be loaded into jigs and rolled into place automatically. Spheres come in diameters 0.002- to 0.125-in. Assure correct volume of solder. *Alloys Unlimited, Inc.*

261—Formable Metallic Packing doesn't deteriorate or harden, so never needs to be replaced—only added to. Eliminates various sizes of packings. In 1-lb. wrapped cakes, it is easily broken off and stuffed into box, gland, or shaft by hand. *Newage Industries, Inc.*

262—Tube Packs of polyethylene, encased in jacket of extruded abrasion-resistant vinyl, are used as air carriers in automatic equipment. The tube pack contains from two to 37 color-coded, small diameter air-pressure tubes. *B. F. Goodrich Chemical Co.*

263—Tumbling Shapes, Honite brand Z-N, is new media for barrel-finishing zinc die castings. Rapid cutting rate reduces barrel time. Slough suspending chip action produces cleaner and brighter work pieces. Mesh abrasive gives fine finish. *Minnesota Mining and Mfg. Co.*

264—Fire-Resistant Fluid provides excellent lubrication with dependable fire protection. May be used in any hydraulic system where this type of fluid is needed. Formulated from specially refined base oil compounded to form a stable water-in-oil emulsion. *Sun Oil Co.*

265—All-Inorganic Zinc Coating has been developed to give high degree of galvanic protection and to eilminate sub-film rusting in salt- and fresh-water and solvent environment. Carbo Zinc #11 is effective at temperatures from −80 F. to +750 F. *Carboline Co.*

266—Sandwich Core Material "drapes" easily for construction of production tools such as welding jigs, holding fixtures, and large molds for forming plastic and light metal parts. Tools are lightweight, have dimensional stability. *Narmco Resins & Coatings Co.*

MATERIALS LITERATURE

267—Industrial Gases, including oxygen, nitrogen, argon, hydrogen, and carbon dioxide, and their uses are covered in Catalog ADC892 (32 pages). Discusses systems for gaseous or liquid delivery and storage. *Air Reduction Sales Co.*

268—Aluminum Foil and its many uses are illustrated in 26-page booklet (Form 20-11306). The foil's versatile properties make it adaptable as insulation, honeycomb cores, panels, capacitors, etc. *Aluminum Co. of America.*

269—Fibrous Glass Tubing, is described in 4-pager. Lists electrical characteristics, flammability, resistance to chemicals, sizes, other data. Hygrade Polytube is flexible. Black, white, standard colors. *L. Frank Markel & Sons.*

270—Hardboard that can be bent without crazing or cracking comes in three panel types: standard, tempered, and perforated. Brochure (8 pages) includes finishing, laminating, fastening methods; sizes, other data. *Weyerhaeuser Timber Co.*

271—"Iron Clad" Concrete Floors are said to last six times longer than ordinary ones. Bulletin MP-4d (24 pages) tells why. Explains causes of corrosion, formulations to meet specific job needs, other details. *The Master Builders Co.*

272—"Aluminum Clad Copper 40%" is title of 4-page bulletin covering high-conductivity wire and applications. The cladding is an aluminum alloy that resists corrosion, can be readily anodized. *Sylvania Electric Products, Inc.*

273—Roof Surfacing Material (Color-Shield) is a liquid for making asphalt roofs white, heat-reflective. Booklet (6 pages) gives applications on roofs and walls; data on reflectivity of various surfacings. *Addex Products.*

FACTORY

CATALOG NEWS

For more about these items, circle numbers on Reader Service Card next to back cover.

MATERIAL HANDLING

1—Docker. This 8-page catalog, "Docker Facts and Factors," discusses the place for the stand-up, end-control truck in material handling systems. Provides information on intermittent operations, etc. *Automatic Transportation Co.*

2—Warehousing System. How time and space are saved with the Stow side transfer system is explained in 4-pager. Elimination of 90-deg. turn of truck is said to cut waste in warehouse aisle space 50% and more. *Equipment Mfg., Inc.*

3—Corrugated Packaging. This 8-page brochure outlines the cost-saving advantages of making corrugated packing and shipping containers in one's own plant. Machine can make from 300 to 500 boxes an hour. *Colt Packaging Machinery Co.*

4—Monorail and Cranes. Installation features and sequence of operation are set forth in this well-illustrated catalog of 54 pages. Includes details of planning and selecting an overhead material handling system. *The Louden Machinery Co.*

5—Pipe and Clamps. "A World of New Uses for Pipe" is a 12-pager (TSA-5) that shows how fixtures can be constructed with ordinary pipe and clamps. Directions for assembling carts, rails, racks, shelves, etc. *Tube-Strut Corp.*

6—Conveyors. This 16-page catalog describes two types of conveyors. "Cable-Way" has capacities of 80, 160, and 250 lb. per trolley; "Chainless," 100 to 400 lb. per trolley. Includes case histories. *The American MonoRail Co.*

7—Truck Control System. This 4-page brochure tells how to get more work per hour from your lift trucks. System reduces the number of operating movements and frees driver's hands for full-time steering and load control. *Hyster Co.*

8—Hydraulic Dumpers. Here's an illustrated 4-pager (D-C59) that tells how dumpers cut costs in handling and emptying bulk containers. Information on work positioning, feeding, mixing, and batching. Dimension tables. *Uhrden, Inc.*

9—Fork Truck. Circular 35K (6 pages) discusses the 24-volt straddle-type electric truck. Meets demand of modern warehousing operation requiring heavy work cycles, extra fast lifts, powerful traction. *Lewis-Shepard Products, Inc.*

10—Bag Slitter. Bulletin (4 pages) tells about advantages of product that opens and dumps multiwall bags. Automatically handles up to 20 bags a minute. Opens bag, removes contents, discards empty bag in five steps. *Wiretyer Corp.*

INSTRUMENTS AND CONTROLS

11—Photoelectric Control. Bulletin GEA-6822 (16 pages) describes easy-to-use controls for counting, sorting, signaling, protecting, diverting, detecting, or limiting job. Specifications and application data. *General Electric Co.*

12—Purge Rotameters. Features of rotameters for indicating and manually controlling small flows are set forth in Bulletin 18P (4 pages). Diagram shows components and design simplicity of basic instrument. *Schutte & Koerting Co.*

13—Thermistor Probes. Characteristics of these interchangeable probes are explained in 6-page bulletin. For use in remote reading of telethermometers and controllers, or as component transducers in special instruments. *Yellow Springs Instrument Co., Inc.*

14—Indicating Gages. Two 4-pagers and 2 single sheets describe Models 211, 212, 213 pointer gages, and Model 214 vertical scale indicator. Gives applications and operating specifications for each instrument. Photos. *The Hays Corp.*

15—Readout System. Illustrated 12-pager (30B1000) tells how multiple-pressure system measures and records hundreds of different pressures simultaneously, using a single high-accuracy transducer. Applications. *Fischer & Porter Co.*

16—Flowmeters and Manometers. Folder of loose-leaf pages combines basic information on indicating instruments for accurate measurement of liquid and gas flow. Design, composition, selection, other data. *Eclipse Fuel Engineering Co.*

17—Control Systems. Completely automatic control for gas engine compressors is described in illustrated 4-pager (3276). Explains start-up procedure, normal and abnormal warning and shutdown control, etc. Photos. *Ingersoll-Rand Co.*

18—Electronic Control. Bulletin No. K-2 (8 pages) discusses system known as K-2 control. The control, its Ajusto-Spede drive and push-button station, make up a drive "package" that provides controlled adjustable speeds. *Eaton Mfg. Co.*

VALVES AND PIPES

19—Centrifugal Castings. Catalog No. 300 is a 16-pager about centrifugally cast cylinders for unified pressure vessels and other applications. Specifications for carbon, high- and low-alloy steels. *Sandusky Foundry & Machine Co.*

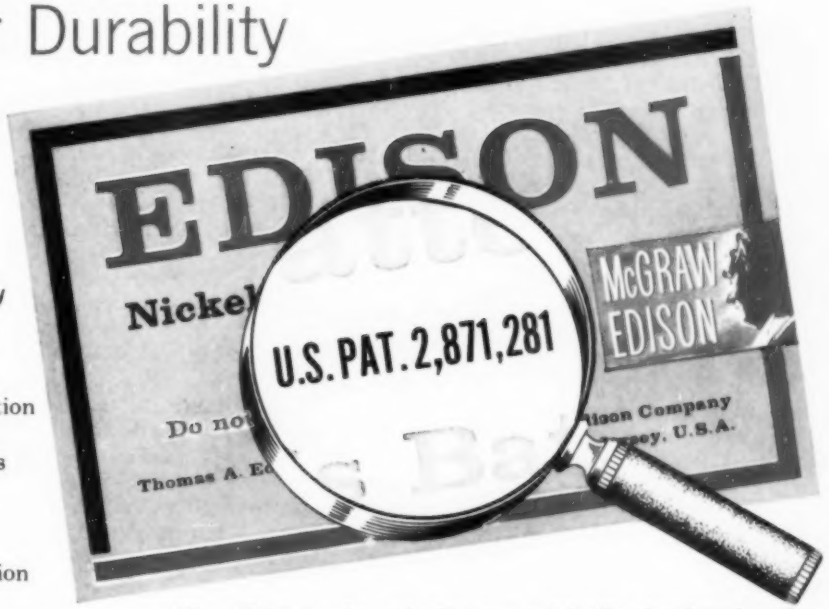
20—Hydraulic Valves. Many facts to help in selecting valves and filters are given in 12-page catalog (No 3000). Includes valve equipment rated up to 3000 psi. Pressure drop charts, diagrams, and photos. *Waterman Engineering Co.*

21—Control Valves. Two illustrated 4-pagers: J-180 on sliding-gate self-operating temperature con-

What you—as a Battery User—
Should know about

U.S. PATENT 2,871,281

New Active Material Gives EDISON Even Longer Life Even Greater Durability



This Label On Your Battery

Means This in Performance

1. Longer life—lower depreciation
2. Reduces maintenance cost
3. Durable—no sudden failures
4. Full shift performance
5. Fully automatic charging
6. No corrosive fumes
7. Lowers cost of truck operation
8. Can stand idle indefinitely
9. Withstands temperature extremes
10. Other uses after heavy duty life
11. Lighter weight
12. Edison Nationwide Service

EDISON—The Higher-Priced Battery that Costs Less

Now EDISON, the only battery originally developed exclusively for electric trucks, *again leads the field* with a new patented active material that means *longer life* and *greater durability*. Tested exhaustively in the laboratory . . . proven, *under torturous conditions*, in the field . . . this new development in active material reduces your annual battery cost to an even lower level and protects the battery against damage caused by excessive overcharging and overdischarging.

EDISON'S free book about this remarkable development is a "must" for battery users. Write Storage Battery Division, Thomas A. Edison Industries, West Orange, N. J.

EDISON NICKEL-ALKALINE STORAGE BATTERIES

Another Product of McGRAW EDISON

For more facts Circle 612 on Reader Service Card

trol valve for heating and cooling; F-47 on remote pump safety shut-off valves. *OPW-Jordan.*

22—Valves. Bronze and iron body gate, globe and check valves are discussed in illustrated 6-pager. Application, design features, and sizes are given for each valve. Pressure ratings range from 125 through 300 lb. *The Fairbanks Co.*

AIR HANDLING

23—Gas-Fired Heaters. Unit heaters with slow-speed centrifugal blowers are described in Catalog No. 1526 (4 pages). Eight models allow choice of ratings from 40,000 to 200,000 Btu./hr. Specifications. *Westinghouse Electric Corp.*

24—Ventilating Accessories. Catalog 35-8 (12 pages) has data on sheet-metal specialties for ventilation, air conditioning, collection, or exhaust systems. Describes round metal ducts, die-formed elbows, quick connectors. *Carrier Corp.*

25—Air Conditioners. Here's an 8-page bulletin (No. 8525) that describes design and construction of packaged air conditioners. Tables give capacities and physical data on air- and water-cooled units. *Industrial Div., American-Standard.*

AUXILIARY

26—Motors, Compressors, Pumps. How "air may do the job" is the subject of 12-page catalog (App-28). Contains case histories of current original equipment applications. Diagrams illustrate pneumatic principles. *Gast Mfg. Corp.*

27—Hydrogen Generators. Here's a 4-pager (H-459) that describes new packaged hydrogen gas atmosphere generators. Includes flow chart and tables of capacities, utility requirements, dimensions; applications. *Gas Atmospheres, Inc.*

28—Vertical Turbine Pumps. Catalog 2400-B1 (16 pages) discusses ultra-high flow pumps redesigned to give broader coverage and higher efficiencies. Thirty-six hydraulic designs cover capacities of 40 to 4500 gpm. *Worthington Corp.*

29—Boilers. This illustrated 12-page catalog discusses packaged firetube boilers through 600 hp. for heating and processing, steam or hot water. Includes construction features through final test and start-up data. *Cleaver-Brooks Co.*

30—Boiler Blowoffs. Possible savings in labor and operating costs through use of continuous boiler blowoff systems are pointed out in Bulletin 5700-A. Systems discussed include simple heat exchangers and flash tanks. *Cochrane Corp.*

PRODUCTION

31—Slitting Equipment. "Slitting Lines for Coils and Sheets" is a revised 76-pager. Gives design, selection, and operation of slitters and slitting lines; time studies and analysis of operating cycles; capacity tables. *The Yoder Co.*

32—Power Tools. Here's a 66-page "case book" (AD1181) that tells how standard power tools are used in combination with other tools, with automatic controls, and in special set-ups. Discusses many tooling problems. *Rockwell Mfg. Co.*

33—Rhodium Electroplating. Facts on properties of rhodium are presented in illustrated catalog (20 pages, revised). Includes details about bath preparations and control of plating formulations. Charts and photos. *Sel-Rex Corp.*

34—Goggle Respirators. This 4-pager (S-8016) describes a one-piece goggle and respirator molded from flexible rubber. Goggle has impact-resistant acetate lens. Mask is lightweight, fits over eyeglasses. *American Optical Co.*

35—Single Spindle Automatics. B-359 (4 pages) tells about two new automatics with 1⅝- and 2¼-in. capacity. Model B feeds stock to 10¼-in. lengths; B-18 to 19½-in. Specifications, speed chart. *The Cleveland Automatic Machine Co.*

36—Indexing Table. Here, in Bulletin X59 (4 pages), are construction details and specifications for two tables that provide angular locating to within ¼ second of arc. Requires about three seconds to index. *Michigan Tool Co.*

37—Machine Cutting Torch. Heavy-duty, medium- and low-pressure torches, tips, and accessories are discussed in 12-pager (ADC-880). Torches may be used with oxygen and a fuel gas. *Air Reduction Sales Co.*

38—Modular Bench System. Bulletin No. 159 describes assembly benches that are not limited to fixed dimensions. At least 34 different layouts can be made with the telescopic members and modular elements. *Products For Industry, Inc.*

39—Far-Infra-Red Heaters. This 8-pager (G-62) presents line of Chromalox heaters and controls. Using far-infra-red wavelength, heaters dry, cure, or bake plastics, textiles, paper, inks, etc. Ratings, other data. *Edwin L. Wiegand Co.*

MECHANICAL

40—V-Belts. Catalog A-11303 (6 pages) shows how Dacron polyester fiber reinforcement gives these V-belts long flex life, few matching problems. Tables of length changes, moisture absorption charts. *E. I. duPont de Nemours & Co.*

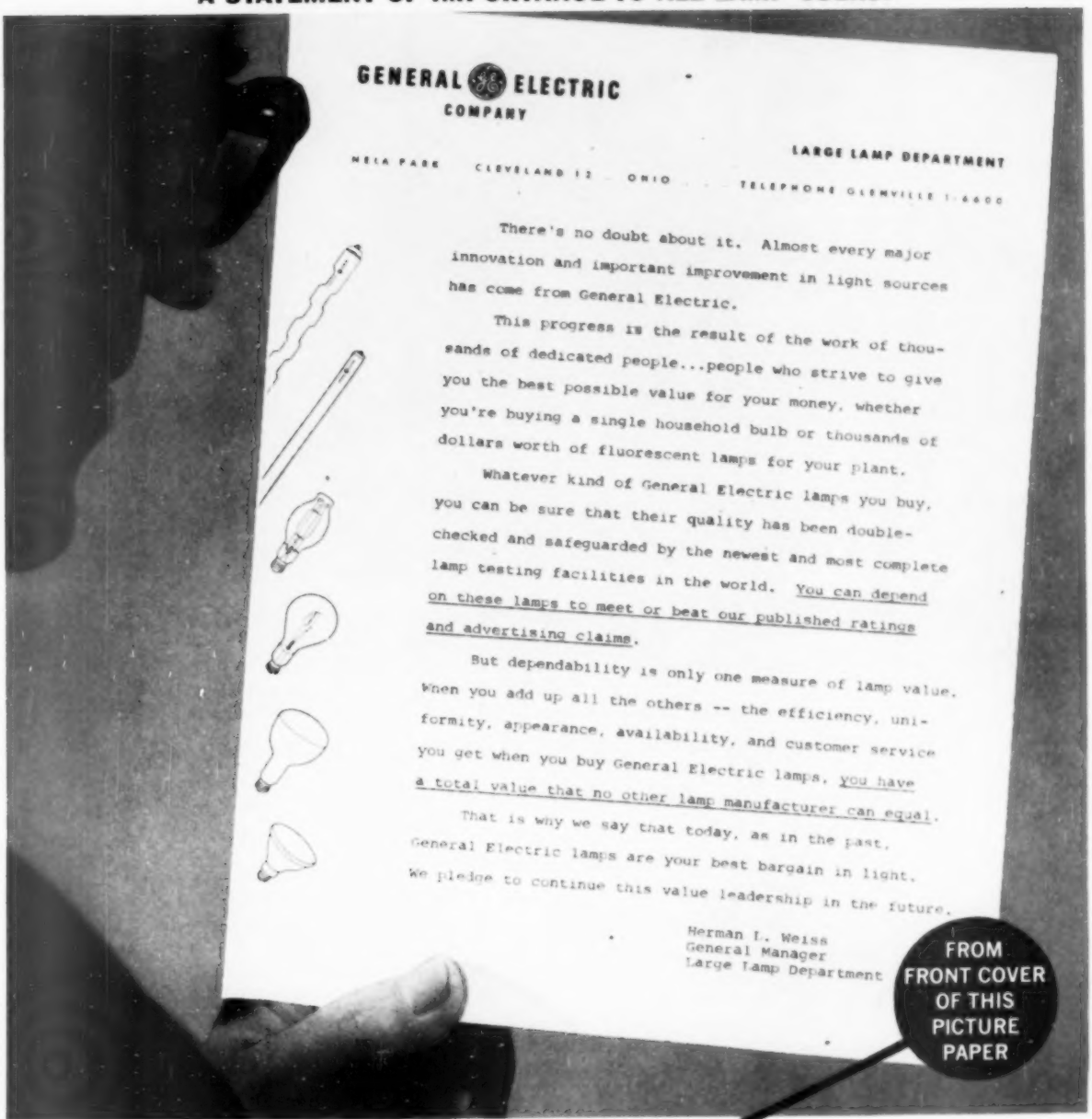
41—Speed Reducers. Self-cooling, fin- and fan-equipped reducers are discussed in 4-pager. Data on three basic styles—one vertical and two horizontal units—in six sizes. *The Ohio Gear Co.*

42—Chain Drives. Bulletin No. 59126 (pocket-size) presents the do's and don't's on installation, operation, and maintenance procedures for chain drives. Will help you avoid costly downtime, premature replacement. *Chain Belt Co.*

43—Worm Gear Sets. Here's a 24-page catalog (No. 3800) with basic data needed for accurate selection of worm gearing. Tells how

"GENERAL ELECTRIC LAMPS ARE YOUR BEST BARGAIN IN LIGHT"

A STATEMENT OF IMPORTANCE TO ALL LAMP USERS:


GENERAL ELECTRIC COMPANY
NELA PARK CLEVELAND 12 OHIO
LARGE LAMP DEPARTMENT
TELEPHONE GLENVILLE 1-6600
There's no doubt about it. Almost every major innovation and important improvement in light sources has come from General Electric.
This progress is the result of the work of thousands of dedicated people...people who strive to give you the best possible value for your money, whether you're buying a single household bulb or thousands of dollars worth of fluorescent lamps for your plant.
Whatever kind of General Electric lamps you buy, you can be sure that their quality has been double-checked and safeguarded by the newest and most complete lamp testing facilities in the world. You can depend on these lamps to meet or beat our published ratings and advertising claims.
But dependability is only one measure of lamp value. When you add up all the others -- the efficiency, uniformity, appearance, availability, and customer service you get when you buy General Electric lamps, you have a total value that no other lamp manufacturer can equal.
That is why we say that today, as in the past, General Electric lamps are your best bargain in light. We pledge to continue this value leadership in the future.
Herman L. Weiss
General Manager
Large Lamp Department
FROM FRONT COVER OF THIS PICTURE PAPER

FREE FROM G.E. Interesting new data-packed, informative 20-page picture paper, loaded with tips on lowering your cost of light with improved lamps, maintenance, lighting layout. Helps you pick the most economical, efficient General Electric Lamps for your specific application. Mail the coupon today.

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Where dirt could mean disaster . . .

Cleaning interior of B-52 Stratofortress during assembly, Boeing Airplane Co., Seattle, Wash.

You'll find SPENCER VACUUM CLEANERS

At Boeing, vacuum is used to remove metal shavings, dirt, solder droppings and stray rivets from areas which subsequently will be covered . . . and to keep foreign particles away from delicate instruments.

And the rugged, high suction Spencer units have a second major function: maintaining general plant cleanliness.

Whatever *your* needs . . . production quality control or routine maintenance . . . there's a full powered Spencer vacuum cleaner to handle the job—*better*. Models from 1½ H.P. to 15 H.P.

Request descriptive catalog No. 155B.

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

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For more about these items, circle item numbers on Reader Service Card next to back cover.

to calculate bearing loads. Diagrams show features of gears. *DeLaval Steam Turbine Co.*

44—Motor Pulley. This 20-page bulletin (V-582-1) describes Vari-Speed motor pulley disk-assemblies and bases said to be the simplest components available. Assemblies come in nine sizes, ½ through 15 hp. Photos. *Reeves Pulley Co.*

45—Speed Drives. "The Modern Mechanical Way to Obtain Adjustable Speed at Low Cost" is subject of 16-pager (GEA-6806). Discusses principles of operation, configurations, other features. Rating tables, etc. *General Electric Co.*

MAINTENANCE

46—X-Raying Pipelines. Here's an 8-page illustrated booklet on the use of x-ray for inspecting pipeline systems. Gives data on welding circular assembly joints. *Gevaert Co. of America, Inc.*

47—Worm Gear Jacks. Bulletin AD-66a (8 pages) lists specifications and applications of Series 1800 jacks with capacity ranges from two to 100 tons. Drawings of jacks, mitre gear box assemblies, and components. *Duff-Norton Co.*

48—Purifiers, Separators. Gas, air, steam, and vapor entrainment problems are discussed in 8-page bulletin (803). Information on mist extractors and scrubbers. Installation and operating data, photos. *The V. D. Anderson Co.*

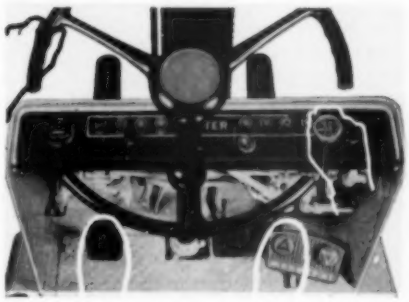
49—Condensifilters. This 4-pager (No. 4158) describes an instrument that combines four units in one—condenser, separator, filter, trap. Two models (M-30T and M-100T) have "Mag-Pneu-Power trap" in units (optional). *Hankison Corp.*

50—Pencil Grinder. You hold it like a pencil but it isn't. The tool is a bladed type motor for use with small carbide cutters, burrs, mounted

Announced in June—

Hyster monotrol trucks are already at work in warehouses and industrial plants from coast to coast.

Acceptance of the new Hyster SpaceSaver 3,000, 4,000 and 5,000 lb. trucks with *Monotrol* control system is even exceeding earlier expectations. In warehouses and industrial plants from coast to coast the new Monotrol trucks are setting new standards of production, safety, and handling economy. The ease of moving more tonnage with less operator effort and greater safety is the story being told by each new owner. Contact your Hyster dealer for a demonstration or write to Hyster Company, P. O. Box 847, Danville, Illinois, for the illustrated brochure.

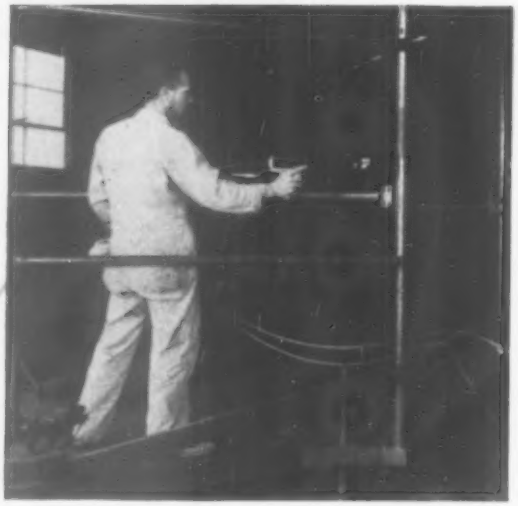


What is Monotrol? It is a revolutionary control system that frees the operator's hands for full-time steering and load control. A single *right* foot pedal controls forward-reverse and speed. A left foot pedal controls precision inching. Push-buttons control automatic parking brake and transmission engagement for complete safety.

HYSTER COMPANY
INDUSTRIAL TRUCK DIVISION

FACTORIES: Portland, Ore. • Danville, Ill. • Peoria, Ill. • Kewanee, Ill. • Nijmegen, The Netherlands • Glasgow, Scotland • Sao Paulo, Brazil • Sydney, Australia (licensee)

FASTER . . . CLEANER . . . MORE ECONOMICAL WHEN YOU PAINT WITH THE RANSBURG Electrostatic Hand Gun



Gator Boat transport trailers are painted in less than half the time—with half the paint—with the new Ransburg Electrostatic Hand Gun.

For instance

Peterson Bros., Inc., Jacksonville, Florida and Ft. Wayne, Indiana, world's largest manufacturer of boat trailers for the Marine Industry, switched from air hand spray to Ransburg No. 2 Process Electrostatic Hand Gun at the Fort Wayne operation in the finishing of their big custom line boat trailers and their Gator line of Marine Trades Equipment.

Paint saving with the Ransburg Hand Gun is estimated at 50 to 60% over the former method. Construction of their products (they use a lot of tubular steel) is ideal for Hand Gun application because of the "wrap-around" characteristic of Electro-Spray.

Painting is done now in an open spray room where two water-wash booths stand idle. Not needed! Maintenance in the paint room has been reduced 75%, for where they used to have to clean up the room sometimes twice a week (mostly on overtime) it now goes two or three weeks without cleanup.

One of Peterson's biggest products now painted electrostatically is a boat transport trailer, Model 807, built to haul six 16-ft. runabout boats. The trailers are over 31-feet long; overall height is 11'-2" and almost 8' wide. With air spray, it used to take 8 hours, or more, to paint the big vehicles. Now, with Ransburg No. 2 Process Electrostatic Hand Gun, one operator does the job in only 3½ hours. And, with half the paint!

NO REASON WHY YOU CAN'T DO IT, TOO!

Write for information and literature about this revolutionary, new painting tool. See how the Electrostatic Hand Gun can save time . . . paint . . . and cut costs in YOUR finishing department. If your production justifies conveyorized painting, it'll pay you to investigate Ransburg's automatic electrostatic spray painting equipment. Write for our No. 2 Process brochure which shows numerous examples of modern production painting in both large and small plants.

RANSBURG

RANSBURG
Electro-Coating Corp.
Box-23122, Indianapolis 23, Indiana

FACTORY / CATALOG NEWS

Begins on page 260

For more about these items, circle item numbers on Reader Service Card next to back cover.

points, and drills. Bulletin 61 (4 pages) has applications, photos. *The Rotor Tool Co.*

51—Waste Disposal System. How to cut costs of plant waste disposal is the subject of this 12-pager (Form No. 66). Discusses types of grindable waste and refuse machine handles. Step-by-step diagram of operation. *Wandel Machine Co.*

52—Fire-Fighting Equipment. Portable fire extinguishers, wheeled units, built-in carbon dioxide extinguishers, and fire detectors are described in P-49 (16 pages). Chart shows which device to use for what fire. *Walter Kidde & Co., Inc.*

ELECTRICAL

53—Variable Speed Drives. An 8-pager (No. 195) gives data on horsepower, duty, speed variation, mounting styles, enclosures, other features of the Speed-Trol drive. *Sterling Electric Motors, Inc.*

54—All-Purpose Cable. Design and performance features of butyl rubber power cable are given in 32-pager (No. 102). Covers available constructions, from 600- to 15,000-volt conductors. Load factor tables. *Anaconda Wire & Cable Co.*

55—Synchronous Motor. Bulletin SS459 (12 pages) describes new enclosed permanent magnet type motor that instantly starts, stops, reverses, steps. Ratings, specifications, torque chart, outline dimensions. *The Superior Electric Co.*

56—Battery Chargers. This 4-page booklet (6259) discusses compact vertically mounted motor-generator chargers that help save floor space How? By mounting the chargers overhead on pillars or walls. *The Electric Storage Battery Co.*

57—Air-Over Fan Motor. Here's application data for determining motor horsepower rating needed in an installation for various air veloc-

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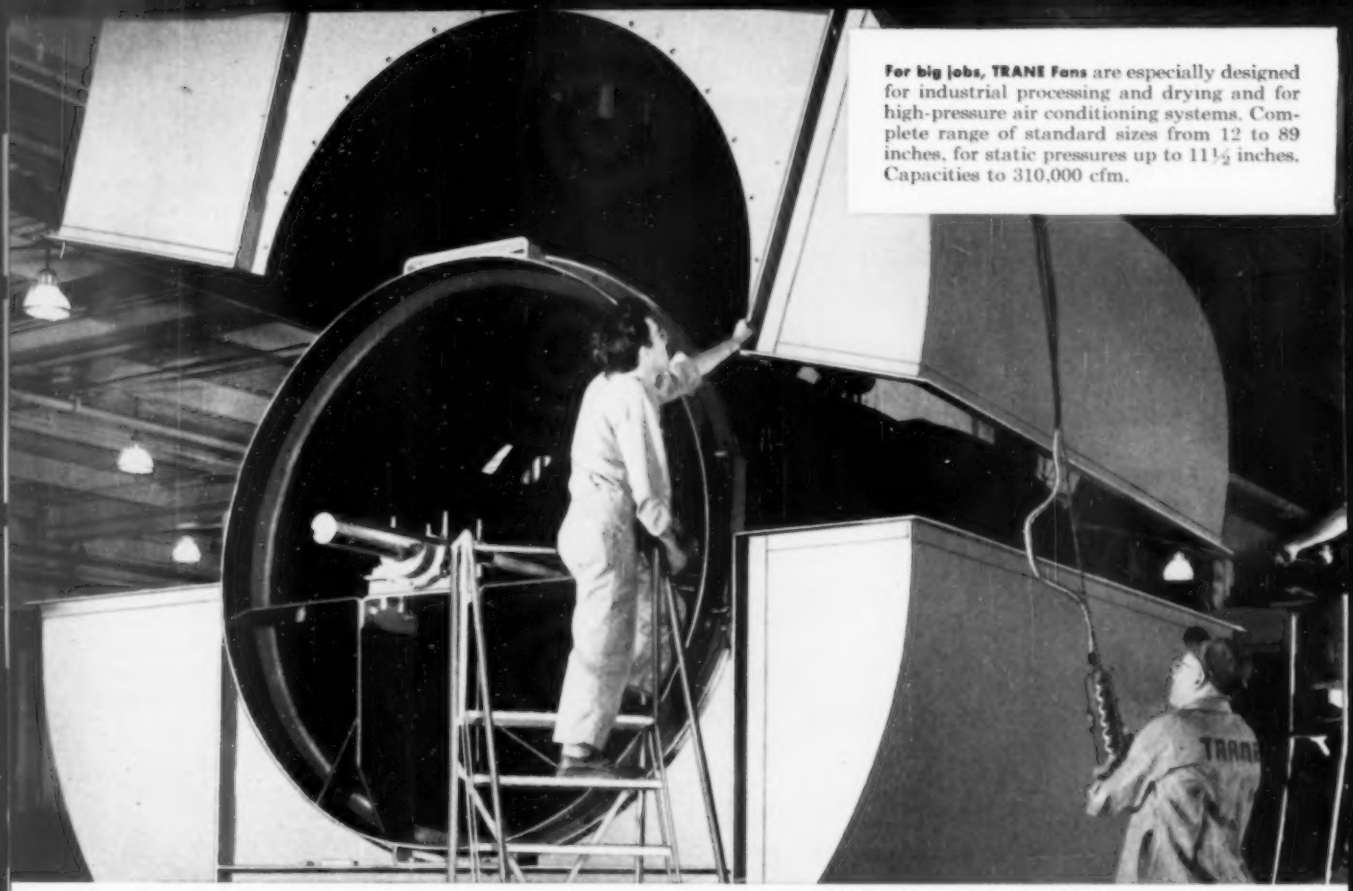


For big jobs, TRANE Fans are especially designed for industrial processing and drying and for high-pressure air conditioning systems. Complete range of standard sizes from 12 to 89 inches, for static pressures up to 11½ inches. Capacities to 310,000 cfm.

Choose a dependable Trane Fan for any process or comfort job!

Accurate ratings, rugged construction assure quiet, efficient operation

The fans you choose for your air-moving jobs—process or ventilation—may mean the difference between top performance and inadequate performance. That's why leading consulting engineers turn to TRANE for fans that are designed for quiet, efficient operation . . . simplified installation and maintenance—and available in a complete range of capacities and types to handle any job.

TRANE Fans are *accurately rated* and ruggedly built. Solid workmanship and the most modern tooling assure consistently dependable performance. And each TRANE Fan design has been tested and approved in the industry's most modern and complete testing laboratories.

TRANE gives you a single, reliable source for *all* your air moving jobs: giant Class I, II and III fans . . . Cabinet Fans . . . Utility Fans—all tested under the AMCA and ASHAE Code. TRANE field personnel in 97 offices are available to help you make the best selection for any air moving job.

When you need a rugged, dependable fan for human comfort or industrial process, turn to TRANE. See your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

WANT MORE FACTS? Write on your letterhead for Bulletins: FC Fans, Class I and II (DS-348-F); BI Fans, Class I and II (DS-348-B); BI Fans, Class III (DS-348-C); Utility Fans, (DS-348-U). Cabinet Fans, (DS-348-D). Axial Roof Ventilators, (DS-364-A). Centrifugal Roof Ventilator, (DS-364-C).

For any air condition, turn to

TRANE

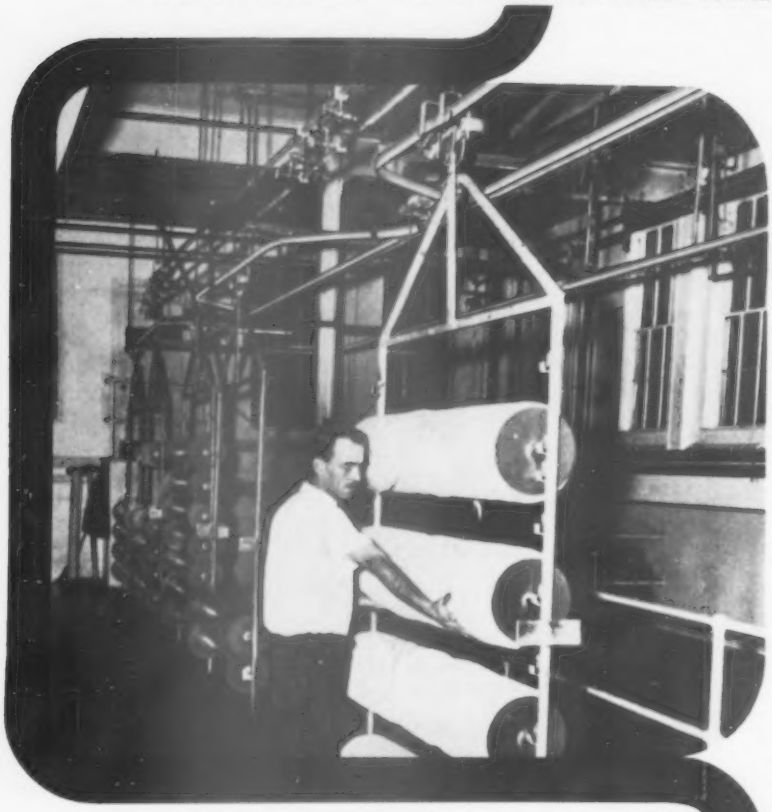
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.—SCRANTON MFG. DIV., SCRANTON, PA. — CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. — TRANE COMPANY OF CANADA, LIMITED, TORONTO. • 97 U.S. AND 10 CANADIAN OFFICES

FOR ROOF APPLICATIONS new TRANE axial flow and centrifugal roof ventilators are especially designed for low silhouette, efficient air movement. Complete range of sizes and models.

PACKAGED UTILITY FANS for fast, economical installation for hundreds of plant ventilating jobs. Exceptionally smooth and quiet in operation. Capacities to 15,450 cfm.

MASSACHUSETTS WOOLEN MANUFACTURER'S PROBLEM SOLVED



POWER AND FREE CONVEYOR SYSTEM

- Eliminates manual handling and reduces manpower requirements
- Moves 160-lb. spools of yarn through a 2-story processing cycle
- Automatically dispatches carriers to several operating stations
- Automatically stores in-process goods by grade and color on gravity lines
- Returns empty carriers to one of 13 loading stations

In this system, power is provided by a regular overhead Chainveyor system. Pusher dogs, mounted directly to the chain serve as the motivating force, automatically moving the loads attached to the free carriers. Free carriers move in storage or free track alongside the power track. Switches automatically shunt carriers off and onto powered lines as desired. Carriers then can travel by gravity or may be hand-pushed on storage or free track.

For further information about Chainveyor power and free systems, engineered for economical automatic materials handling write:

QUALITY OVERHEAD CONVEYOR SYSTEMS

CHAINVEYOR®

CORPORATION

Engineers & Manufacturers

DISTRIBUTORS IN ALL PRINCIPAL CITIES
DISTRICT SALES OFFICES • CHICAGO, DETROIT, JACKSONVILLE, NEWARK, NEW ORLEANS

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FACTORY / CATALOG NEWS

Begins on page 260

For more about these items, circle item numbers on Reader Service Card next to back cover.

ities across the motor. Catalog No. 2950 (4 pages) has motor dimensions, diagrams. *Louis Allis Co.*

58—Selenium Rectifiers. Need a step-by-step method for selecting specific rectifiers for circuit applications? Illustrated 24-pager (ECG-344) describes manufacturing processes, gives voltage and current charts. *General Electric Co.*

59—Capacitor Motors. Bulletin SDA-145 (4 pages) describes ½- to 7½-hp. motors in frame sizes from 56 to 286U. Data includes principles of operation and construction. *The Peerless Electric Co.*

60—Circuit Breakers. Low-voltage power circuit breakers are subject of Bulletin S-4261-2B (8 pages). Ratings, drawout construction, selection chart, application table. *I-T-E Circuit Breaker Co.*

PLANT SITES

61—Warwick, R. I. "The Perfect Place to Live and Work" is a brief booklet about Rhode Island's largest city. Covers taxes, transportation, etc. *Warwick Industrial Development Commission.*

62—San Mateo, Calif. Why is it called San Francisco's Peninsula Executive and Research Center? Read this 16-pager, which describes San Mateo's attractions for executive and research development. *College of San Mateo.*

63—Vermont. "On the Move" discusses Greater Burlington—its sites and buildings, cultural and other advantages. Another bulletin gives industrial data. *Greater Burlington Industrial Corp.*

64—Upstate New York. Advantages of area, including availability of general and skilled labor, are detailed in 28-page catalog. Another booklet, "At Your Command" outlines plant location services. *Niagara Mohawk Power Co.*

For more facts Circle 618 on Reader Service Card

For more facts Circle 619 on Reader Service Card ➤

Enlargements of this illustration, suitable for framing, are available upon request.

Cutting the cost...of a "mountain" of steel desks!

Two attachments were recommended by the Clark Engineers consulting with this company: 1) A Slndr-Arm Clamp to eliminate the need for pallets, 2) A Triple Stage Upright for extra high stacking without sacrificing the lift truck's ability to work in low-overhead rail cars.

The end result was a big boost in storage capacity, *one-truck* handling from warehouse storage to loading-out . . . a need for fewer trucks.

Your nearby Clark dealer, a materials handling specialist in his own right, has access to the same team of factory specialists that developed a "first" in this Company's industry. You'll find him anxious to offer you similar assistance. Call him direct, or write: Materials Handling Specialists, Clark Equipment Co., Battle Creek, Michigan.

CLARK® EQUIPMENT

H in U.S.A.

MSA reports on:

How to Select an Air Cleaner

MSA reviews here some of the factors which influence selection of air cleaners. A speaking acquaintance with these factors can save a lot of time and money. If you would like to dwell further on any of these points, please drop us a line. We believe we can be of great help in answering questions on your specific air cleaning problems.

CLASSIFICATION OF PARTICULATE LOADS—Let's draw a parallel. Because of the heavy dust load in a sand blast booth, you would have to select a sand blast mask instead of a dust respirator. Selection of a particulate space filter is much the same proposition. You must determine the quantitative nature of the particulate load.

For this purpose, let's briefly classify particulate loads. A light load is 0.1 to 1 grain per 1000 cu. ft. A medium load is 1 to 1000 grains per 1000 cu. ft. A heavy load is 1000 grains and up per 1000 cu. ft.

One grain per 1000 cu. ft. = 2.3 mg per cubic meter = 2.3 micrograms per liter. One milligram is equivalent to 0.015432 grains. As a comparison, the concentration of the U. S. Bureau of Mines silica dust test is approximately 22 grains per 1000 cu. ft. of air.

CLASSIFICATION OF NORMAL LOAD RANGES—Country air usually registers 0.2 grains/1000 CF. Small town air ranges from 0.2 to 0.4 grains/1000 CF. City residential air ranges from 0.4 to 0.8 grains/1000 CF. City industrial air ranges from 1.0 to 2.0 grains/1000 CF. And air from industrial operations weighs in at 4.0 to 8.0 grains/1000 CF. 7000 grains, incidentally, is equal to 1 lb.

CLASSIFICATION OF PARTICULATE CLEANERS—Your actual load condition will determine which group of particulate cleaners is of immediate interest to you.

For the heavy loads: gravity separators, cyclone separators and sonic collectors.

For the medium loads: all of the above plus bag filters, impingement type box filters, and wet collectors.

For the light loads: box filters of both types and, in addition, electrostatic precipitators.

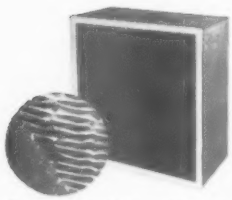
Of course, if you require ultra filtration on heavy load conditions, you should use M-S-A® UltraAire* Space Filters after the heavy duty filters.

PHYSICAL CHARACTERISTICS OF THE PARTICULATES—These characteristics affect the choice of filtering methods and/or design of the filtering system: Particle size, particle shape, specific gravity of particles, particle surface characteristics, packing or plugging characteristics, electrostatic charge on the particle, stability of the particle.

PHYSICAL CHARACTERISTICS OF THE AIR STREAM—These factors too, are worthy of investigation: Density of air, moisture in air stream, temperature of air stream, chemical and physical effect of gaseous contaminants.

DEGREE OF FILTERING OR CLEANLINESS REQUIRED—We'd like to suggest here, that you give some thought to the toxicity or harmfulness of the particulate matter. Evaluate too, the need for cleanliness, product control, equipment maintenance, etc.

ECONOMIC FACTORS—Factors to weigh under this heading are installation costs, space requirements and operating and maintenance costs (including cost of moving air through system, replacement, etc.).



M-S-A® UltraAire* Space Filter

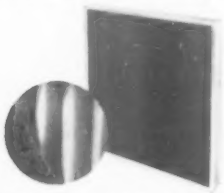
Lightweight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pre-tested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.

M-S-A® Cylindrical-Type UltraAire* Space Filter

Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems and round ducts. Easy to handle. Inexpensive to ship.

M-S-A® Dustfoe* Space Filter

Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Atmospheric Air Dust Stain Rating.



M-S-A® Air-O-Kay* PreFilter

Impingement type panel prefilter which can be used oiled or dry to remove lint and other large airborne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.

Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations.

Fluid Purification Specialists for 45 Years

MINE SAFETY APPLIANCES COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pa.

MSA*

*Trademark

Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators; space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.

For more facts circle 620 on Reader Service Card

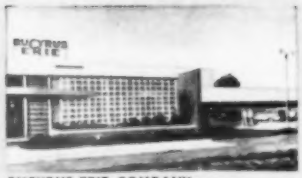
For more facts circle 621 on Reader Service Card→

BRADLEY WASHFOUNTAINS

AGAIN

IN AMERICA'S FINEST PLANTS

ABOVE: 54-inch circular Washfountain; at right: Semi-circular wall type models.



BUCYRUS-ERIE COMPANY
Richmond, Ind.
Designer-Engineer-Builder:
The H. K. Ferguson Company, Inc., Cleveland

CUTLER-HAMMER, INC.
Lincoln, Ill.
Designer-Engineer-Builder:
The Austin Company, Cleveland
Plumbing Contractor: J. F. Weiskopf & Son, Springfield, Ill.

CHARLES BRUNING COMPANY, INC.
Mt. Prospect, Ill.
Engineer-Architect: A. Epstein & Sons, Inc., Chicago
Plumbing Contractor: Marcus Weil & Sons, Chicago

TEXAS INSTRUMENTS INCORPORATED
Dallas, Tex.
Architects: O'Neil Ford & Associates, San Antonio; Richard S. Colley, Corpus Christi; A. B. Swank Associates, Dallas
Plumbing Contractor: Beard Plumbing Co., Dallas

NATIONAL BISCUIT COMPANY
Fair Lawn, N. J.
Designer-Engineer: Nabisco Engineering Department
Plumbing Contractor: Frank A. McBride Co., Paterson, N. J.

KAISER ALUMINUM & CHEMICAL COMPANY, Ravenswood, W. Va.
Engineer-Designer: Kaiser Engineers, Division of Henry J. Kaiser Company

SQUARE D COMPANY
Glendale, Wis.
Architect: Grassold-Johnson & Associates, Milwaukee
Designer: Brooks Stevens Associates, Milwaukee
Plumbing Contractor: P. J. Grunau Co., Milwaukee

FACTORY MAGAZINE'S *Top Plant Awards* 1959

Each year for 25 years, *Factory's* editors have selected Ten Top New Plants. It is noteworthy that so great a majority of such Top Plants have Top Washing Facilities—Bradley Washfountains.

The 1959 selections include—Bucyrus-Erie plant, Richmond, Ind.; Charles Bruning, Mt. Prospect, Ill.; Cutler-Hammer, Lincoln, Ill.; Kaiser-Aluminum & Chemical Corp., Ravenswood, W.Va.; National Biscuit, Fair Lawn, N.J.; Square D, Glendale, Wis.; Texas Instruments, Dallas, Texas.

And among the 1958 Top Ten there were: Automatic Electric Co., Northlake, Ill.; Beckman-Helipot Corp., Newport Beach, Calif.; Chrysler Corp., Twinsburg, Ohio; Johnson & Johnson, North Brunswick, N.J.; Marquardt Aircraft Co., Ogden, Utah; The Martin Co., Orlando, Fla.; National Lock Co., Rockford, Ill.; Polaroid Corp., Waltham, Mass., all Bradley equipped.

Better Washing Facilities In Less Space

Employees like the ease of water control by means of the foot ring, eliminating need for faucets—they like the cleanliness of the big self-rinsing bowl.

Economy of space, installation and maintenance costs—the maximum in sanitation—have lead to the wide use of Bradley Washfountains in plants of every size and kind—25-man plants and those employing hundreds and thousands.

When considering new plants, extensions, or improvements, install Bradleys . . . Latest catalog mailed on request.

BRADLEY WASHFOUNTAIN CO.
2215 W. Michigan St., Milwaukee 1, Wis.

BRADLEY *washfountains*

Distributed Through Plumbing Wholesalers

Write for Catalog 5601

BRAND-NEW radiotelephone (Kaar) is low-cost, specially designed for channels just opened up for industrial use.

REDESIGNED walkie-talkie takes advantage of easier FCC rules, now is even more useful in plants (e.g., taking stock).

How to get the most out of . . .

The Newest in Two-Way Radio

All at once come easier rules, more channels, lower prices, new equipment. Result: a breakthrough in plant communications—and a needed break for you.

THERE'S BIG NEWS today in industrial two-way radio. It comes from two sources: (1) the Federal Communications Commission (FCC), which has changed some of its rules; and (2) radio manufacturers, who are introducing new and modified equipment that runs the range of performance and cost.

What does this news mean to you? It means new guides for selecting two-way radio equipment for your plant (facing page). It means an opportunity to use two-way radio better—if you're already using it. If you aren't yet using it, now may be the time to move. Here's what today's news means:

- More radio channels available for industrial use.
- Easier licensing.
- Greater flexibility in equipment.
- A wider selection of equipment to suit your particular needs.
- Lower-cost installations (in many instances).
- More speed, lower cost, better safety, and new flexibility for many of the jobs that two-way radio can do for you. For instance, in purchase and pick-up (by your own trucks) of small parts from local suppliers; in dispatching delivery trucks, fork trucks, and bulk-handling trucks inside and outside your plant; in obtaining maintenance and repair parts during breakdowns; in paging supervisors and maintenance men in plant, car, field, elsewhere.

How old rules hurt—Under the old FCC rules, two-way radio in plants was pretty well limited to one channel in the very high frequency (VHF) band and five channels in the high frequency (HF) band. (For definitions of VHF and other terms, see panel, page 274. You had to show real need to get a license on an uncrowded channel. Unless your plant was isolated, you got interference from other users. And because radiotelephones had to meet tough FCC stability requirements, they usually cost from $300 to $800 for each unit in the system.

Industry had two other choices—neither widely used:

1. Settle for LPI (low-power industrial) operation on one of six channels in the HF and VHF bands. Licenses were easy to get. But three channels had to be shared with other users, and power was limited to three watts. Equipment was fairly expensive ($400 to $450) in spite of low power, because frequency stability requirements were tight and equipment sales were limited. Other restrictions limited use and range of LPI operation. For instance, antennas had to be within 25 feet of the transmitter.

2. Use the UHF citizens' band. Here, licensing was easiest. Theoretically the band had room for 200 different Citizens' Radio Service (CRS) Class A stations (definition, page 274) in each area with no

By LEO G. SANDS, Consultant
Ridgewood, N. J.

Newest Guides for Selecting Two-Way Radio

Four Questions and Answers About the New FCC Rules

	Manufacturers' Radio Service			Citizens' Radio Service		
	HF	VHF	UHF	A	B	D
Can you communicate . . .						
. . . for business reasons?	Yes	Yes	Yes	Yes	Yes	Yes
. . . for personal reasons?	No	No	No	Yes	Yes	Yes
. . . with other licensees?	No	No	No	Yes	Yes	Yes
. . . over other channels?	No	No	No	No	No	Yes
Can you get a license if you . . .						
. . . are a manufacturer?	Yes	Yes	Yes	Yes	Yes	Yes
. . . serve a manufacturer?	No	No	No	Yes	Yes	Yes
. . . have no special need?	No	No	No	Yes	Yes	Yes
. . . are alien-owned?	No	No	No	No	No	No
Can you use . . .						
. . . base station with remote control?	Yes	Yes	Yes	Yes	No	No
. . . selective signaling (dial, code, etc.)?	Yes	Yes	Yes	Yes	No	Yes
. . . fixed station (plant-to-plant)?	Yes	No	No	Yes	Yes	Yes
. . . relay station (mobile)?	No	No	Yes	Yes	No	No
. . . relay station (plant-to-plant)?	No	No	No	Yes	No	No
. . . portable units?	Yes	Yes	xxx	xxx	Yes	Yes
Are you required to . . .						
. . . monitor CONELRAD?	Yes	Yes	Yes	Yes	Yes	Yes
. . . limit antenna height?	No	No	No	No	Yes	Yes
. . . measure your frequency periodically?	Yes	Yes	Yes	No	No	No
. . . maintain a log?	Yes	Yes	Yes	No	No	No
. . . stick to FCC-assigned channel?	Yes	Yes	Yes	Yes	Yes	No
. . . obtain a base station operator permit?	Yes	Yes	Yes	No	No	No
. . . get a mobile station operator permit?	No	No	No	No	No	No
. . . stay within number of channels available to one licensee?	Yes	Yes	Yes	Yes	Yes	No
. . . use licensed operator to service transmitter?	Yes	Yes	Yes	Yes	Yes	Yes

How the Job Affects Selection

Communicating Job to Be Done	Maximum Distance (Miles)	ORDER OF CHOICE: Manufacturers' Radio Service			Citizens' Radio Service		
		HF	VHF	UHF	A	B	D
INSIDE THE PLANT							
Fixed stations	1	1			x	3	2
Personnel on foot	1	2	1	xx	xx		3
Base-to-mobile	1	x	2	1	x	x	3
Mobile-to-mobile	1	x	2	1	x	x	3
OUTSIDE THE PLANT							
Plant-to-plant	1	1			x	3	2
Plant-to-plant	10	2			1	x	3
Plant-to-plant	30	1			2	x	3
Plant-to-plant	50	2			1*		
Plant-to-home	10				1	3	2
Plant-to-home	20				1		2
Base-to-mobile	5	3	2	1	x	x	x
Base-to-mobile	15	2	1	3	x		
Base-to-mobile	50		2	1*	x*		
Mobile-to-mobile	2	2	1	3	x		x
Mobile-to-mobile	50			1*	x*		

*—With relay station.

x—Equipment available but not widely used because of price, size, performance limitations, or FCC restrictions on use.

xx—Equipment not available.

How Cost and Performance Affect System Selection

	COMPARATIVE RATINGS: Manufacturers' Radio Service (Frequency)			Citizens' Radio Service (Class)		
	HF	VHF	UHF	A	B	D
COST						
Initial equipment	Med	Med	Hi	Hi	Low	Low
Installation	Med	Med	Hi	Hi	Low	Low
Maintenance	Med	Med	Hi	Hi	Med	Low
Test equipment	Low	Med	Hi	Hi	Med	Low
Power demand (battery or a-c)	Med	Med	Hi	Hi	Low	Low
PERFORMANCE						
Reliability	Hi	Hi	Med	Med	Low	Med
Channel interference	Med	Low	Low	Med	Hi	Hi
Noise	Med	Low	Low	Low	Hi	Hi

NOTE: Prices overlap among the six systems above. Extremes of high and low are underlined. Higher-priced equipment generally performs better; lower-priced, poorer.

Your Dictionary of Two-Way Radio Terms

AM—Amplitude modulation. Most common form of impressing voice modulation on transmitter's radiated carrier. More subject to interference, but permits cheaper, simpler circuits. Needs less channel "space."

Base station—A station at a fixed location used for communicating with mobile stations as well as other fixed stations.

CRS—Citizens' Radio Service. Refers to 90 channels in HF and UHF bands set aside for use by individuals, partnerships, or corporations. Almost any kind of communication is allowed—commercial, professional, pleasure. Individual station frequencies are not assigned by FCC (except Class A). Licensing is simple. There are three classes:

Class A. Allows 60 watts input, in UHF band only. Requires precise control of frequency. No limit on antenna height.

Class B. Limited to one frequency —465 mc. (one megacycle = 1000 kilocycles)—in UHF band. Five watts (input). Minimum restrictions in frequency drift permit inexpensive equipment. Range is limited by low power and 20-ft. antenna height.

Class D. Limited to 23 channels in the 27-mc. band. Five watts (input). Antenna height limited.

Fixed station—A station at a fixed location used only for communicating with other fixed stations.

FM—Frequency modulation. Voice modulation varies transmitting frequency. FM sets are more free from interference. Usually heavier, more expensive, and complex.

HF—High frequency ("low band"). Between 3 mc. and 30 mc. HF-MRS and CRS radiotelephones operate in channels in 26- to 28-mc. band.

Mobile unit—A portable transmitter carried on or by a person or installed in a conveyance of any kind, whether operated when conveyance is in motion or not. All Class B and D CRS stations are classed as mobile units regardless of whether they are used for fixed, base, or mobile service.

MRS—Manufacturers' Radio Service. Refers to 35 channels in HF, VHF, and UHF bands specifically set aside for manufacturers. Individual station frequencies are assigned by FCC to limit interference. Power limited to 3, 30, or 60 watts depending on need, type of transmitter, and frequency assignment.

Relay station—A station that receives a signal from one station and retransmits it to one or more other stations. If any of these other stations are mobile, the relay station is a mobile relay station.

Squelch—A special circuit built into the receiver for operator comfort. It silences the speaker except when an incoming signal is present. This cuts out low-level noises, but may also cut out low-level signals. Used primarily on UHF and VHF sets. Not included in cheaper units.

UHF—Ultra-high frequencies ("ultra-high band"). Between 300 mc. and 1000 mc. UHF-MRS and CRS operate in 460- to 470-mc. band.

VHF—Very high frequencies ("high band"). Between 30 mc. and 300 mc. VHF-MRS operates in 15 channels in the 153- and 158-mc. bands.

mutual interference. But equipment was costly ($700 and up for typical mobile units). CRS Class B operation (on one party-line channel only) made it possible to use low-priced equipment. But power was limited to three watts, antenna height was limited, only a few suppliers made durable equipment, information on application was sketchy, and channel interference was often bad. Range was limited to line of sight.

NOW YOU GET MORE

Late last year FCC reshuffled many channel assignments—and changed the rules. The results:

More channels—FCC assigned 35 MRS (Manufacturers' Radio Service) channels exclusively to manufacturers—and cut individual channel width. (Present radiotelephones must be modified for narrow-channel operation.) Channels now are available in the HF, VHF, and UHF bands. Power up to 60 watts is allowed.

Bigger, better citizens' band—FCC also created a new citizens' band and brought order out of chaos in the old one. Of the 200 UHF channels, 69 are retained for UHF citizens' radiotelephone use. A specific frequency for each channel is laid down. Sixty-eight channels are available to Class A (60-watt) stations. One channel—465 mc. (megacycles)—remains available to Class B (now 5-watt) CRS stations.

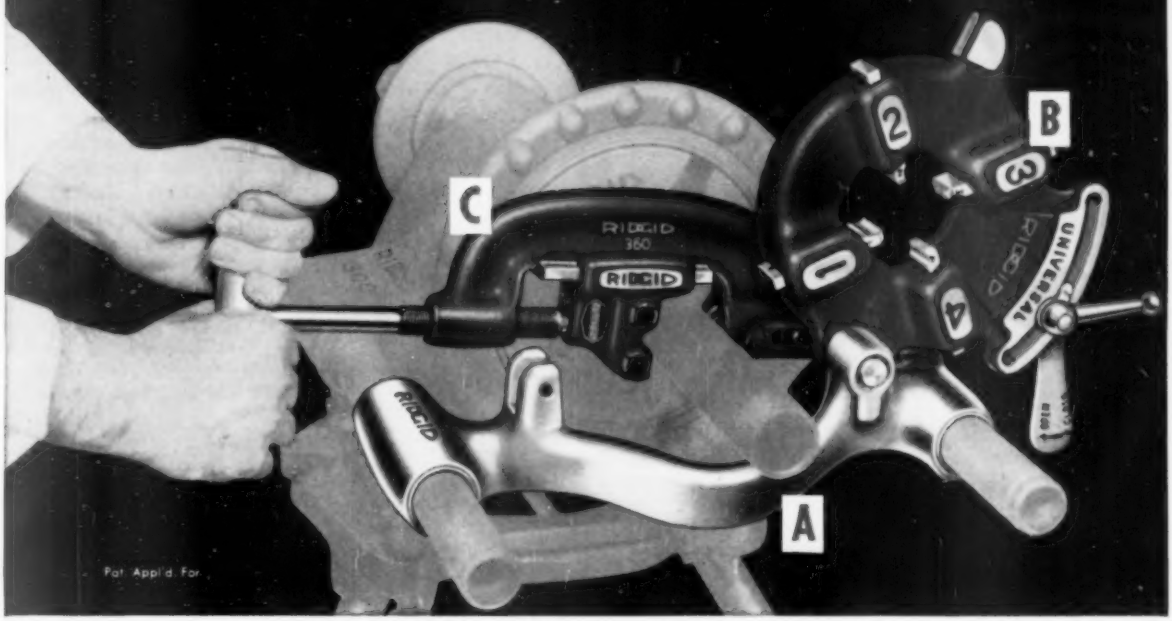
Brand-new channels—This is still bigger news to industry. FCC opened 23 new CRS channels in the choice 27-mc. HF band and reserved 22 for a new type of CRS operation—Class D. And it upped power limit to five watts.

Here's what the two CRS changes above mean to you (see table, "Four Questions and Answers," page 273).

- You can use radiotelephone at home or in your car—even in your boat. That's because CRS channels are open to almost any kind of communication—personal and business. (MRS is limited to business communications.) Only limit on CRS: You may not use it for communicating with an MRS station except through another station equipped with both types of transmitters.
- You can get a license easily. Any citizen over 18 years old, any partnership or corporation (unless alien-owned), is eligible to apply.
- You can get more range. Transmission on new bands is less affected by objects in line of sight.
- You can get durable equipment at modest cost. Equipment technology for CRS is pretty well advanced. (This contrasts with UHF operation, in which experience is still limited and set makers don't yet have a wide choice of low-priced components or circuitry.

Turn the page

Now!... Convert Your RIDGID 300 POWER DRIVE to a fast, smooth, low-cost pipe and bolt threading machine!



"3 Efficient, New RIDGID Accessories Save Me Time on Every Job!"

A RIDGID **No. 310 Carriage** — Slip this strong, lightweight aluminum alloy carriage on the support arms of your RIDGID 300 Power Drive, and you'll get real cut-and-thread efficiency! Holds die head and cutter at your fingertips exactly like a pipe machine. No fumbling for right size threader . . . no tools to drop. Easy sliding . . . snugs right up to chuck for close threading and cut-off.

B RIDGID **Die Heads** — The time-saving RIDGID 535 Quick-Opening Die Head shown here, or any other RIDGID Machine Pipe and Bolt Die Head, snap-locks into carriage quickly, easily... eliminates slow back-off. Single adjustment on carriage centers die head exactly for true threads every time.

C RIDGID **No. 360 Cutter** — Full-floating, wheel-type cutter... wide rolls for straight cuts at pipe machine speed. Attaches easily with swivel drive pin. Fits 310 carriage only.

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Interior view of Goodyear plant shows how Structoglas glazing transmits ample light, tinted and diffused by panels' "Softlite Green" color.

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WRITE TODAY for Goodyear Case History and new Structoglas Glazing folder (SL-1). Structoglas Inc., Dept. 903, Cleveland 9, Ohio.

5902

TWO-WAY RADIO

Begins on page 272

Bargain prices—The breakthrough in price (CRS) as well as new channel space (CRS and MRS) give you new range in selecting equipment for your plant. So . . .

- If you could use two-way radio but haven't yet sought a license (unable to prove need, equipment too costly, unwilling to keep records, or discouraged by crowded usable bands), you should look at the new opportunities opened up by FCC.
- If you've found two-way radio useful already, you can probably add another system for a third to half the cost of your original layout. Why add another system? Maybe to separate purchasing and expediting communications from shipping. Maybe to end the confusion between inplant and outside radio traffic.

FINDING WHAT'S BEST

There's no one best system. But if you'll use the "Newest Guides to Selection" on page 273, you'll get helpful clues.

Start with the first table, "Four Questions and Answers." See what you can and can't do with various types of equipment. That's the first step in making your selection.

Then go to the second table, "How the Job Affects Selection." See which kind of system will best do the job you have in mind.

Next, go to the third table, "How Cost and Performance Affect System Selection," and study comparative ratings of the six systems.

Finally, measure your findings from the three tables against the equipment descriptions in the text that follows.

WHAT SYSTEMS WILL DO

Take the six types of equipment available: MRS—HF, VHF, UHF; CRS—HF (Class D), UHF (Class A and Class B). Here's what they'll do for you and what they'll cost:

- **HF-MRS**—Radiotelephones for this service are rugged and dependable. Expensive, too ($500 and up). The best-known manufacturers make them. Optional features are available (e.g., communication with one station only, through coded signaling). All systems use frequency

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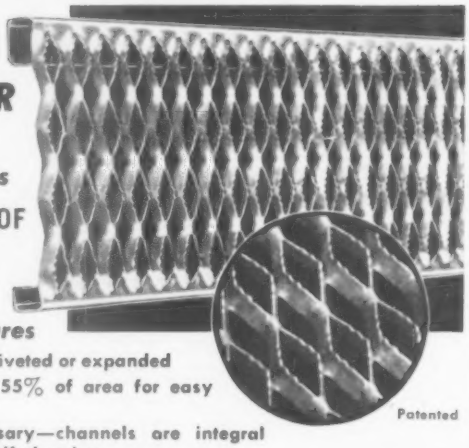

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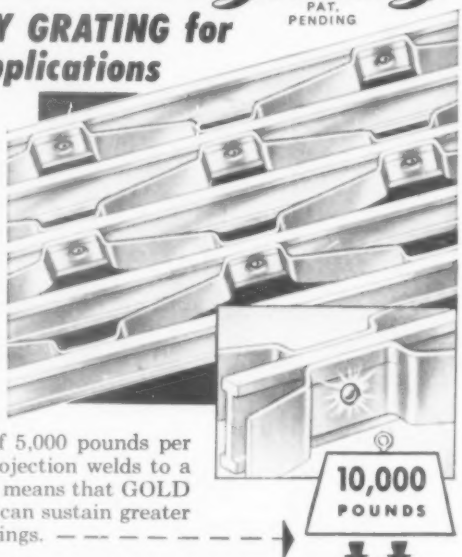

PROJECTION WELD

Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.

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The GLOBE Company MANUFACTURERS SINCE 1914
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Begins on page 272

modulation (FM). Where minimum cost is important, you could use the stable Class D CRS units on MRS frequencies if you keep power below three watts and insert a crystal matched to the assigned frequency. But if you do so, you must operate your CRS unit on a specific FCC-assigned frequency.

You can also obtain a reconditioned MRS mobile unit, modified to meet the new FCC standards, for as little as $120.

• **VHF-MRS**—A wide choice of base, mobile, and portable equipment to use in the 15 channels available. Equipment is generally lighter and less costly. Most big manufacturers are in the field. Prices: $350 to $600. All manufacturers except one use FM. Transmission is considered to be line of sight. But a minor obstruction (such as a small hill) is not as likely to cut off communication as with UHF.

• **UHF-MRS**—Most equipment makers who provide VHF-MRS sets also provide UHF units for base, portable, or mobile use. Prices here are higher—$575 to $800 and up. Most units are FM. Twenty channels are open to industry. Equipment is generally smaller and lighter than HF or VHF sets of the same power. But you may need more power to cover the same range.

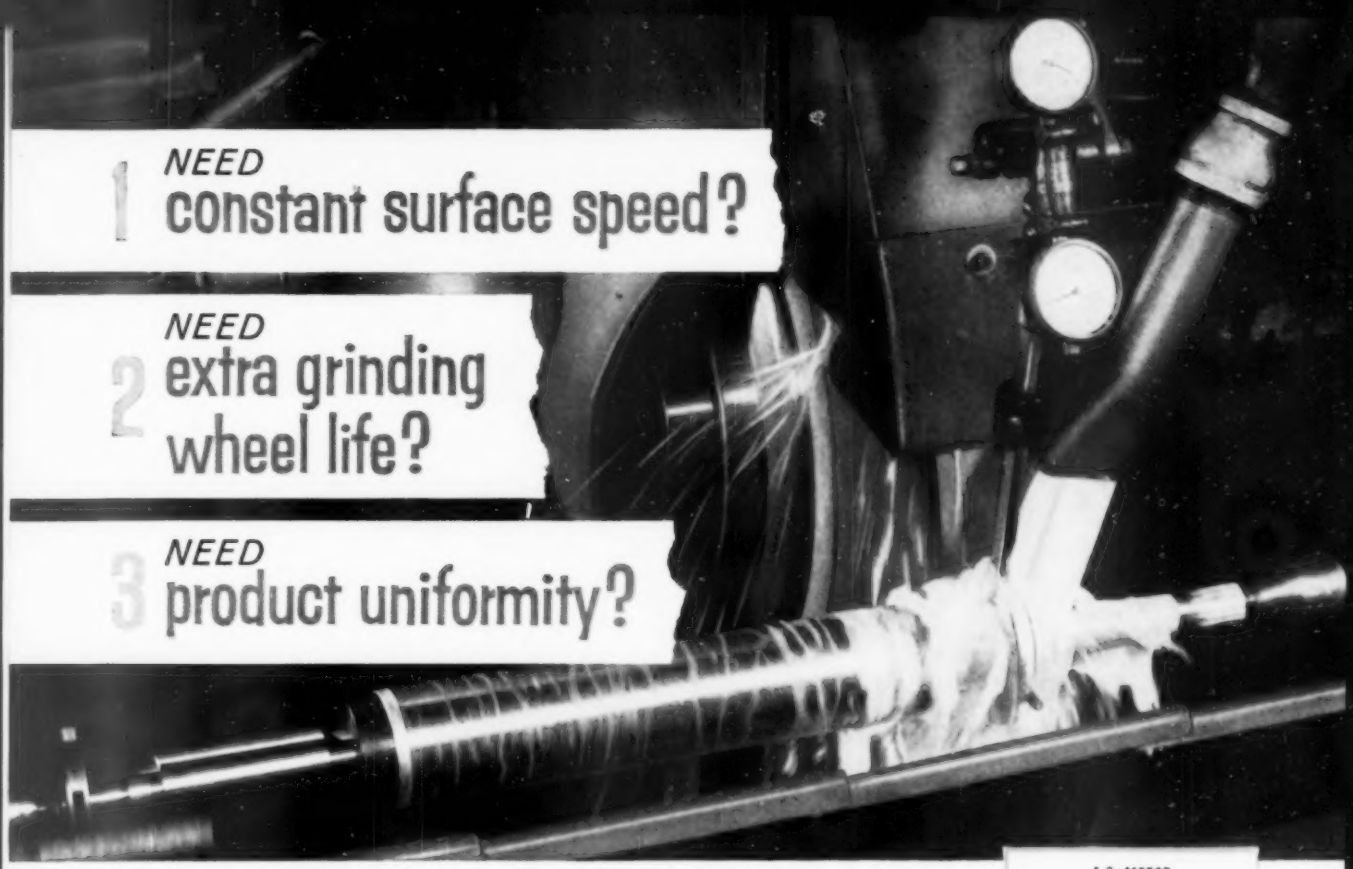
• **HF-CRS, Class D.** This is the new bargain equipment. You can buy radiotelephones in the 23 low-band Class D CRS channels for as little as $42.95 in do-it-yourself kits. Extreme price range, $75 to $360; average range, $145 to $165. Units use AM. Range, from 1 to 20 miles or more; par, about 5 miles. Units are packaged for portable, mobile, and desk-top use.

Stations operate on any of the 23 CRS low-band channels. You don't need FCC permission to change to another channel (to dodge local interference, for instance).

• **UHF-CRS, Class A and Class B.** Two classes of equipment are available—at opposite extremes of price and quality.

Class A. Stations operate on the newly assigned frequencies. Stability requirements are strict. Power up to 60 watts is permitted. Units are offered by most of the same manu-

For more facts Circle 625 on Reader Service Card



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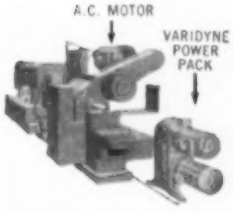
BEFORE INSTALLING VARIDYNE, grinding speed changed as wheel circumference wore down.



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facturers who make UHF-MRS units. Price, $575 to $800. Mobile, ruggedized units cost more. Either FM or AM is allowed, but most commercial units use FM.

Class B. Stations operate on 465 mc. Since FCC doesn't require close frequency control, equipment is inexpensive. Normal abuse won't cause detuning. Antenna height is strictly limited. Radiotelephones are suitable for point-to-point communication over distances from 1 to 10 miles. Only one manufacturer now makes this equipment. Portable units cost from $75 to $105, have no squelch circuit (see "Dictionary," page 275). A base unit with squelch sells for about $200.

FITTING UNIT TO JOB

Most systems eventually involve more than one type of communication. So, to make the right choice, you must balance costs against adaptability. For instance, a bargain-priced Class D CRS system may be all right for keeping maintenance headquarters in touch with a machinery repair truck. But if you ever expect to use the truck to service vehicles stalled even a few miles from the plant, you may find the system completely useless—too little power, or interference from other nearby Class D stations on the same channel. You'd be wiser to apply for a license that permits greater output, and for an assigned frequency free from local interference.

If it's too costly to handle all communications with one system, you may want two or more systems—each for the job it does best.

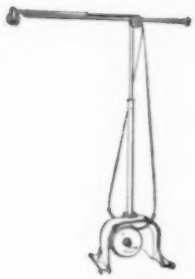
Here are the various kinds of jobs radio systems are designed for, plus data on cost and operation.

Intra-plant fixed stations—Where distances are great, or phone lines can't be tied up, or fixed station locations are often changed, you can use two-way radios instead of standard intercom systems. A few examples: from engineer's office to temporary construction headquarters, from temporary warehouse office to inventory control department.

Best equipment for this use is HF-MRS. But cost usually rules against it except in very large plants, or

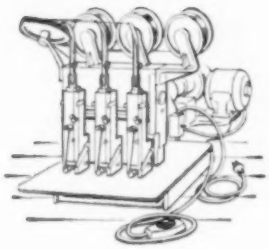
CLOSURE IDEA BULLETIN

For Users of Fibreboard Boxes

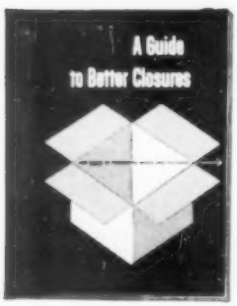


Users needing low-cost, high-volume closure of all types of fibreboard boxes find characteristics of wire stitching method particularly advantageous...economical ...continuous long runs without frequent need to reload...coils hold enough wire for many thousands of stitches.

Wire tangling, snagging, eliminated by positive brake action on Acme Steel 25 and 50 lb. coil holders...machine or floor mounted. Model P1A0 coil holder for single head stitchers holds two 50 lb. coils of wire...wire feeds from first coil while second coil is ready for instant threading ...floor standing model...does not have to be fastened in any manner to floor or stitcher. More details in AD-159.



Toy manufacturer uses Acme Steel Wire Stitcher, Model 600 Champion, to stitch plastic bubble to display card as protection over toy accordion. Stitched cards assemble faster, stay intact better. Operation described completely in W4-2.



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ACME STEEL WIRE STITCHING

For more facts Circle 628 on Reader Service Card

where one or more of the stations will eventually be part of a base-to-mobile system. For most intercom jobs Class B or D CRS units will do.

When Class B sets ($75-$105) are used, communications are heard at all stations (yours and your neighbor's) within range. The same is true when Class D sets operate on the same channel.

With Class D, you can use different frequencies independently, so each activity will have its own radio intercom system. You can handle communication between systems by using multi-channel radiotelephones at supervisory locations. Class B and D units can be put in operation quickly—a plug-in antenna will cover up to a square mile.

If a Class D transmitter is stable enough to meet FCC's MRS requirements (this means a more expensive set), it has one advantage: You can shift it over to MRS-assigned channels if local use of CRS channels is so wide that plant communications are hamstrung.

Intra-plant mobile—Class B units can handle communication between one or more base stations and any number of vehicles (switch engines, material-handling and over-the-road trucks, yard cranes, etc.) within a small plant. A large area needs at least a Class D CRS system.

MRS, UHF, and VHF equipment will usually give the best intra-plant mobile coverage, without same-channel interference. Low-power VHF-MRS equipment ($300 to $400) will cover up to about five miles with a moderately high base-station antenna. High-power mobile UHF-MRS equipment ($575 to $800) will provide more than adequate coverage. But its higher cost can seldom be justified now that VHF and HF bands are open to manufacturers—unless you use it for extended range coverage.

Long-distance fixed stations—Two-way communication (say, between shipping or receiving and a branch plant or customer or a supplier's plant) up to 20 miles is possible with Class D CRS units ($75 to $200) if terrain is ideal and interference is minimum. If Class D antenna height is the problem, you can buy sets that are stable enough

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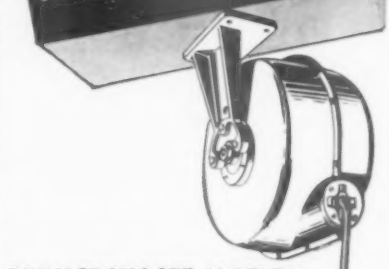

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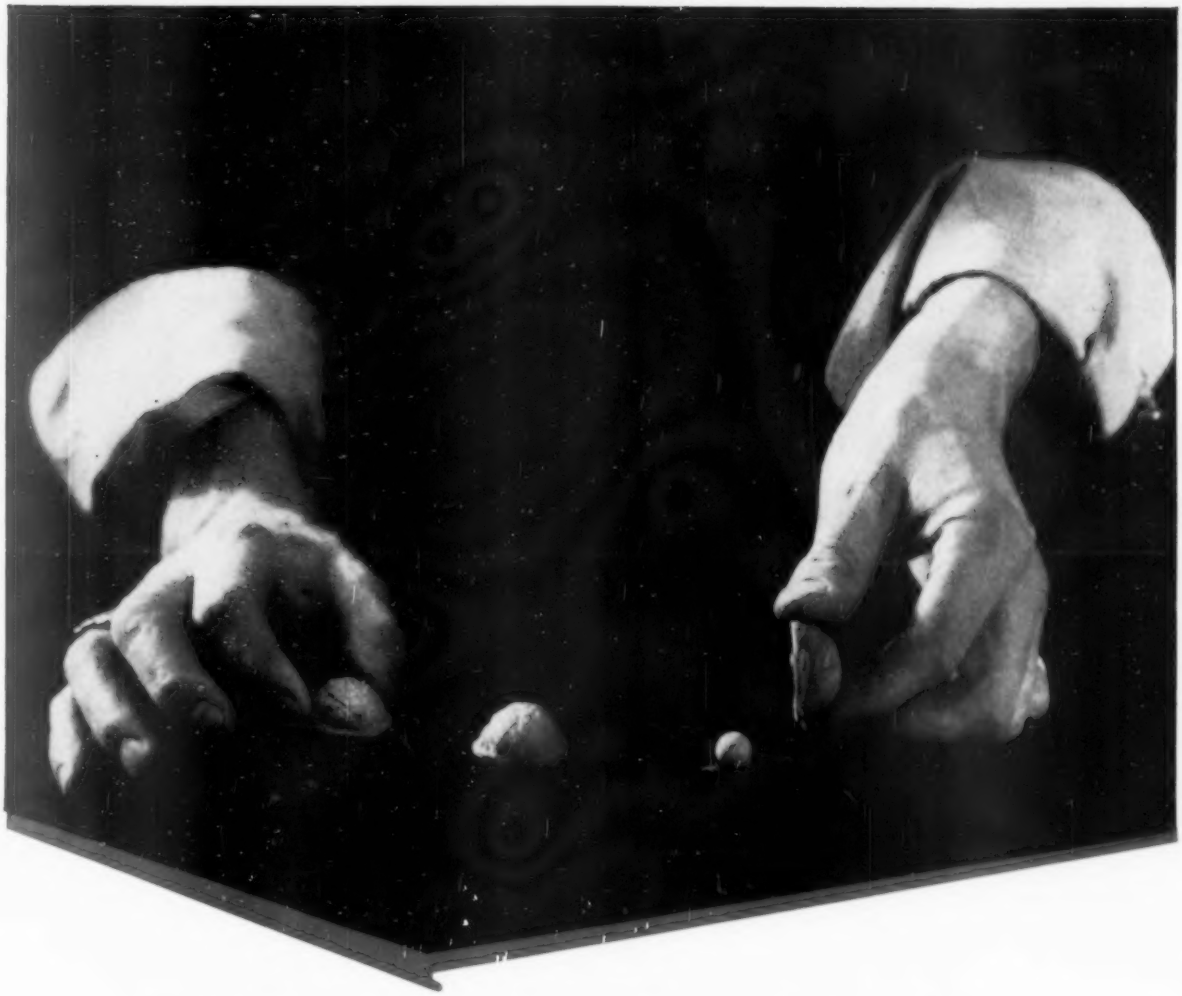

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for HF-MRS licensing, drop power to three watts, place the antenna at the highest feasible point (with transmitter near it to avoid antenna lead loss), and operate by remote control. A 3-watt station with the right antenna may do far better than a 5-watt station in a hole.

For best communication up to 50 miles, MRS-HF units up to 30 watts may be the answer. FCC does not require that mobile units be included in an HF-MRS system to obtain a license. You can provide any MRS fixed station with remote control units so that it will be available to many departments.

Long-range point-to-point communications can also be provided by 10- to 60-watt UHF equipment —CRS Class A or MRS-licensed— if terrain or antenna height doesn't limit range. When licensed for CRS Class A, fixed stations need not be part of a mobile radio system. But a license for MRS-UHF (or VHF) operation requires fixed stations to be base stations operated primarily for base-to-mobile and secondarily for point-to-point communications.

Long-distance mobile—For communicating between a plant and vehicles operating 5 miles from the plant (e.g., purchasing department to trucks on local pick-up), Class D equipment may be adequate. For greater dependability the 10- to 30-watt HF-MRS equipment, 10- to 60-watt VHF-MRS or UHF-MRS equipment is recommended. Maximum-range HF-MRS channels are available only on a shared-with-others basis. This may limit their value if your mobile unit operates closer to other transmitters than its own base station.

Walkie-talkie—This is the hand-carried two-way radiotelephone. These units form a special category. Use is growing in plants spread over wide areas—e.g., chemical and petroleum plants, steel mills. With a few walkie-talkies, any key man can be in instant touch with any other station in the system, including other walkie-talkie users. Some units are built for either personal or vehicle use. Communication between a pair of units ranges from several hundred feet to two miles or more. Range between a walkie-talkie and

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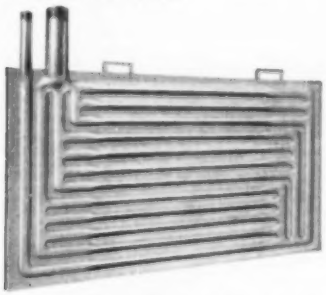

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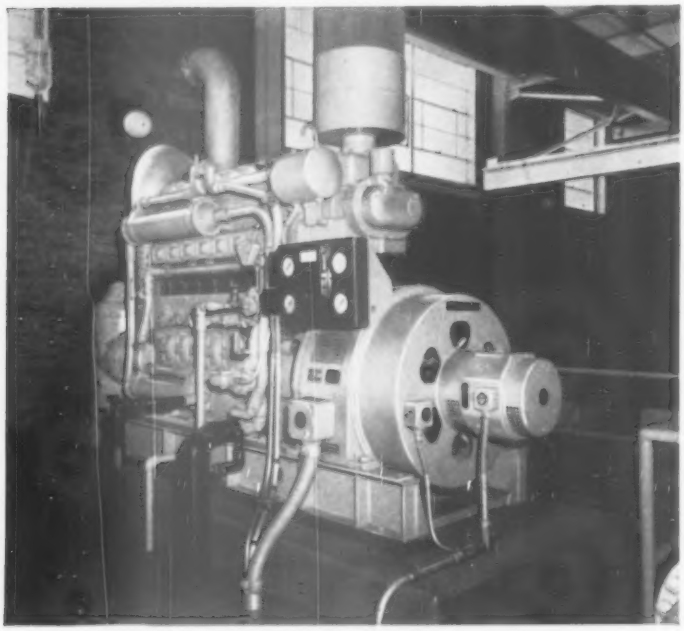

Compact, lightweight Model 38F5¼ O-P is rated 450 hp. at 1200 rpm., direct drives a 175-kw. F-M alternator and, through right-angle gears, an F-M Pomona Vertical Turbine Pump with 5.5 mgd. capacity at discharge pressure of 105 psi.

Electric power off the flywheel end, high-service pumping off the front—that's the standby job cut out for this Model 38F5¼ Fairbanks-Morse O-P Diesel in the Elyria, Ohio water works serving 60,000 people.

Called into service for 3 to 6 hours a day in the Spring of 1958, the O-P pumped water for $1.50 less per million gallons than purchased power—a $300 per month reduction, including savings on demand charges. Each Saturday the engine makes a test run as the sole high-service on the line.

Versatile as well as economical, the Model 38F5¼ O-P is also ideal for direct-driving other equipment off the rear, with front end of shaft driving an auxiliary generator, crusher, pump, etc. The O-P can be furnished for either diesel, dual-fuel, or spark-ignited operation, and is available as a complete packaged unit with all accessories attached to the frame. Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

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Begins on page 272

a higher-powered base or mobile station may be much greater.

Miniature units. These are the HF and VHF belt-type transmitters and receivers ($500 to $550). Units provide good receiving range, but transmission distance is limited by 1- to 1.5-watt transmitter output. A new pocket-size CRS Class D radiotelephone is available for about $100. Range of miniature portable-to-portable sets is much affected by large obstructions.

Larger units. These are rugged units available from most of the well-known manufacturers ($200 up). They operate in the HF and VHF-MRS bands. None are available for UHF operation. All are FM. Range between a pair of these units is 1 to 2 miles. Newer transistorized designs promise even lighter units with reduced battery drain.

Radio paging—This is one-way rather than two-way communication. But paging is available on some of the more expensive MRS units. Paging systems are available in three major types:

1. *Pocket receivers.* There are two kinds: selective and non-selective. User of the non-selective type holds the instrument to his ear at frequent intervals to hear if he is being paged. Calls are repeated at intervals until canceled. With a selective receiver, a beep or a lamp signals the paged person to check in by telephone.

When non-selective pocket-pagers are used, an AM transmitter of up to 30 watts may be used when licensed for operation as an HF-MRS station. A CRS radiotelephone (Class D) may be used for voice paging. In industrial service the receiver section is normally used only to monitor the channel to make sure that a paging call does not interfere with communications in progress.

2. *Vehicle receivers.* These can be specified with loudspeakers for aural radio paging, or with decoder units that signal by buzzer or lamp when vehicle is called. Where a mobile transmitter is not used, reply is usually by telephone. Accurate selective paging calls for plenty of power to override interference. A 30-watt HF transmitter should be able to handle even a very large

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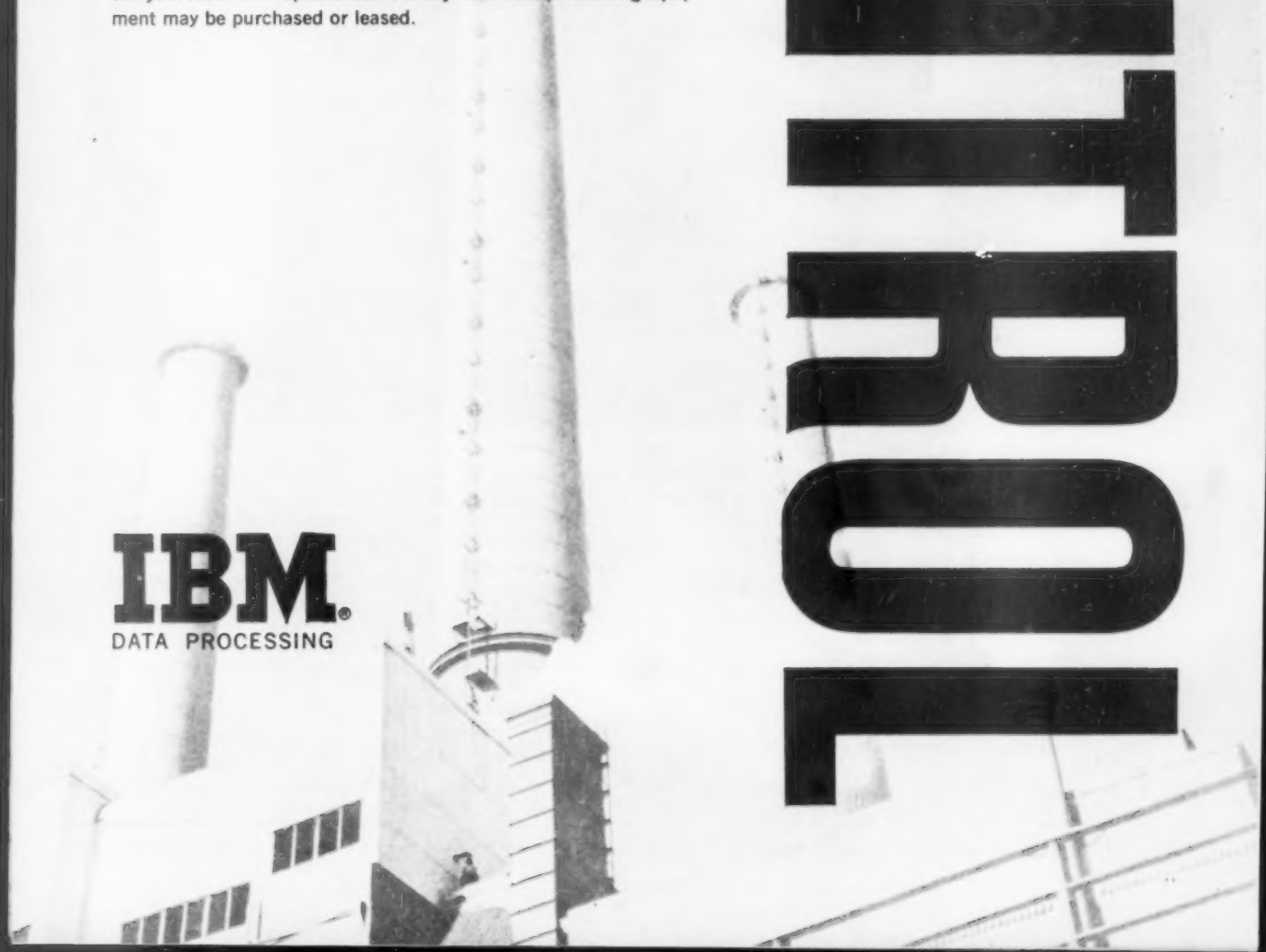

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plant, plus outside personnel many miles away.

3. *Non-radio receivers.* These use low-frequency electromagnetic induction. They're not really radio at all, since the receiver must be inside a transmitting "loop" that encloses all or part of a plant building or group of buildings.

Mobile relay station—You can use this (see "Dictionary," page 274) for expanding the area coverage of a mobile radio system 10 to 20 times or more. A relay station picks up signals from any mobile or base station in a system on one frequency and rebroadcasts on another frequency. This way, it can be heard by all stations in that system.

The two antennas (one receiving, one transmitting) are installed at highest elevation (e.g., a water storage tank or a tall smokestack). Unattended automatic relaying equipment is mounted conveniently for servicing and inspection.

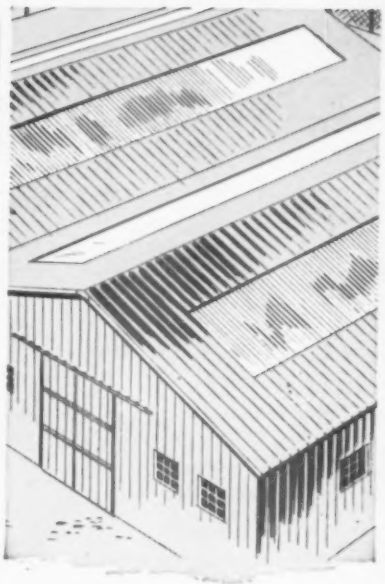
Equipment for a relay station, exclusive of antenna, costs from $600 to $1000 or more. Relay stations can be operated only in the UHF band and only by MRS and Class A CRS licensees.

HANDLING RADIO PROBLEMS

Steel structures—VHF is considered somewhat better than HF for communicating from the outside into metal buildings. Inside a building with many metallic surfaces, UHF works best of all, because UHF signals (which travel much as light does—line-of-sight path) are reflected from metal surfaces. Communication in and out of a fully shielded area is impossible. But there are few such areas, since any open doors or joints destroy the shielding. Many plants find no problem in using either VHF or HF to communicate with trucks traveling in and out of steel warehouses.

Noise—This may be the most important factor in selecting your equipment. Severe ignition noise and other plant-originated electrical interference can cause annoyance and serious loss of effective range. Fortunately there's little noise trouble in the UHF band.

Noise *can* be a problem in the HF



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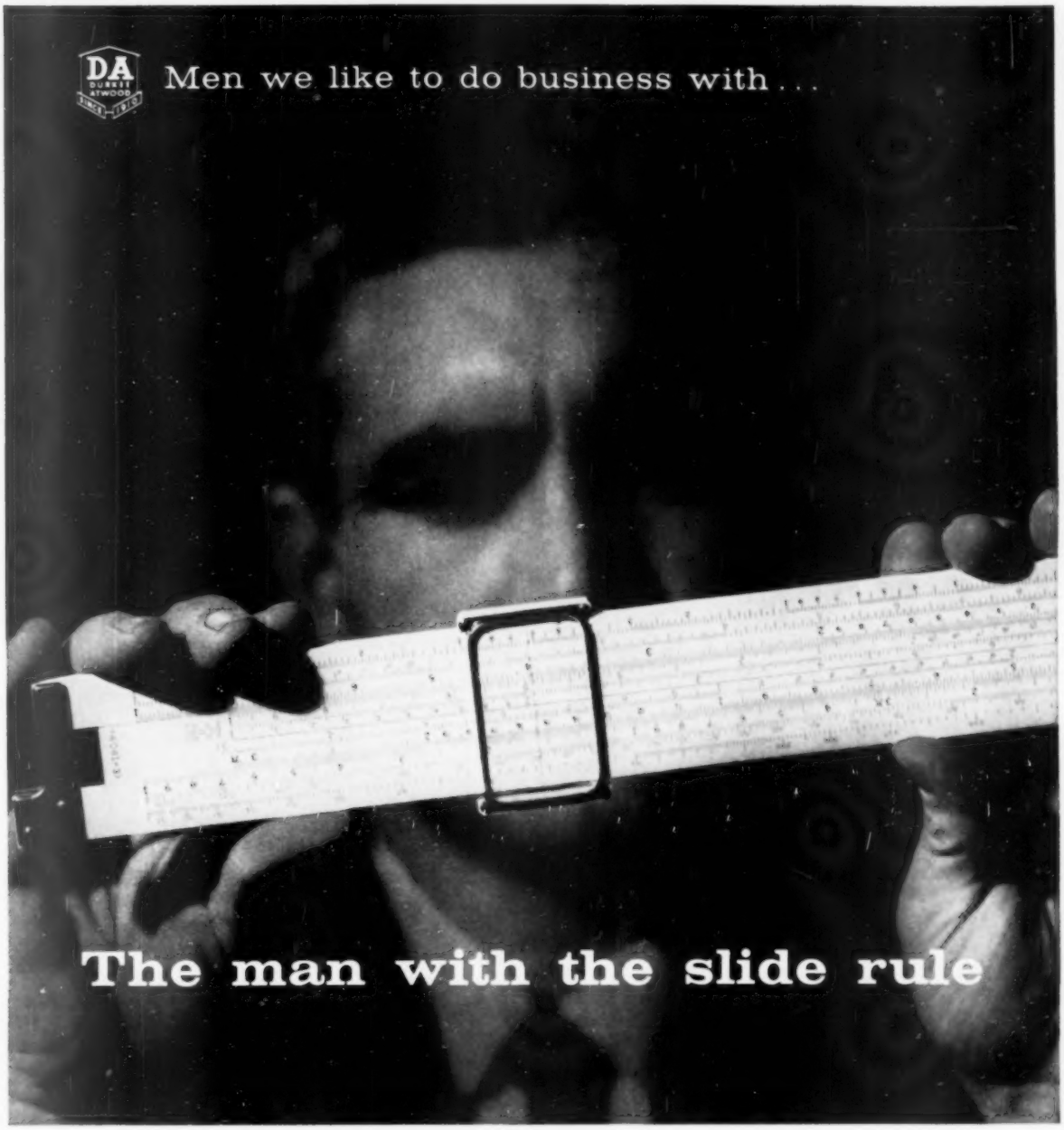

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That's the kind of man we like to do business with, because we can show him exactly how he gets extra benefits with Durkee-Atwood V-Belts. Durkee-Atwood offers V-Belt *Quality* that meets the most demanding needs of industry, quality that has proven itself under severe usage . . . prompt *Service* when you need special attention and help . . . real money *Savings*, too (and the eyes of the "slide rule" man light up at that).

Durkee-Atwood, one of America's pioneer V-Belt manufacturers, offers a complete line of Multiple V-Belts, General Duty V-Belts and Steel Cable V-Belts—built to *last*!

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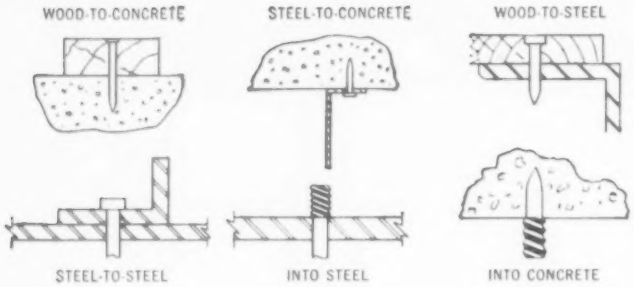

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band. Most of the better MRS sets solve the problem by using FM. The more expensive CRS Class D sets are equipped with a noise-limiter circuit that reduces impulse-type noise (e.g., sparking electrical contacts and ignition systems). But noise limiters vary widely in effectiveness. If your plant (or your nearby neighbor's) is a bad source of noise, you may not be able to use CRS Class D equipment at all.

Big problem in many plants is acoustical noise. The output of some low-priced receivers may not be high enough to be heard above ambient noise. Most mobile radio equipment uses a cone-type loudspeaker. Where penetrating volume is required, a substitute reflex horn-type loudspeaker may be worth the small investment involved.

Installation and service—The old-line manufacturers sell their equipment through dealers or distributors, most of whom are equipped to install it. Most of the new entries into the Class D CRS equipment field sell through local wholesale radio parts distributors, few of whom provide installation.

Doesn't matter what type of equipment you use. The fact remains, transmitters must be tuned, adjusted, and repaired only by persons who hold a first- or second-class commercial radio operator's license—or who work under direct supervision of a license holder. Anyone may repair the receiver. Fixed-station units may require servicing only once or twice a year. Key mobile stations that get rough usage need inspection monthly at least.

Most plants farm out their radio maintenance to specialists. Hundreds of independent mobile radio maintenance shops throughout the country service industrial radio equipment on a service contract or parts-and-labor basis.

Some independent service contractors charge a flat fee—around $6 to $8 monthly per mobile unit. Tubes and parts are extra. Some charge more and provide everything. On a non-contract basis, typical rates are about $7.50 per hour.

If you now have a competent electronic maintenance technician, he should be able to qualify for an

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with

AUTOMATIC'S

New Skylift Electric Truck equipped with CURRENT-MISER-CONTROL

AUTOMATIC'S Model ELF Electric Truck has been designed for operation in plants and warehouses requiring a highly maneuverable and efficient industrial truck, with fast travel speed and lift speed. Example—4,000-lb. model, loaded, has a 6-MPH travel speed. Capacities: 4,000 thru 10,000 lbs.

Check for yourself...you'll find that a substantial part of your battery power, while maneuvering in low speeds, is dissipated through heat loss by resistors. Now, Automatic's New Skylift Electric Model ELF equipped with Current-Miser-Control gives you the precise power you need *without waste!* It achieves low RPM ranges with up to 60% less amperage draw. Result—considerable saving in cost of battery power.

New Cost-Saving Benefits of the CURRENT-MISER-CONTROL

- Up to 60% less current draw operating in low speeds
- Infinite number of speeds
- Lower motor operating temperatures
- Lower cost per battery
- Longer battery life
- More driving power in low speeds
- Increased contactor-tip life
- Increased motor-brush life

Advanced Materials Handling at Less Cost to You

Electric Automatic® Industrial Trucks

AUTOMATIC TRANSPORTATION COMPANY

Division of The Yale & Towne Manufacturing Company

39 West 87th Street, Dept. P-9, Chicago 20, Illinois

WORLD'S LARGEST EXCLUSIVE BUILDER OF ELECTRIC-DRIVEN INDUSTRIAL TRUCKS

Please rush complete information on the Skylift Model ELF with revolutionary new Current-Miser-Control.

Name_____ Title_____

Firm Name_____

Address_____

City & Zone_____ State_____

39-P9

SERVIS RECORDERS
installed on 17
Lift Trucks
SAVED $40,000
A YEAR

EVERYBODY
was happy!

WORKERS no longer complained about discrepancies in pay checks—they knew the Servis Recorder work-record was right!

OTHER OPERATING DEPTS. and even the training school received several of the lift trucks no longer needed on their previous assignments due to the new efficiency!

THE DEPT. SUPERVISOR received a cash award for efficiency!

MANAGEMENT . . . well, $40,000 savings ain't hay! Management thinks Servis Recorders are wonderful—in fact they have bought 30 more! (Name of this company furnished on request.)

AND you?

You can profit, too, with Servis Recorders. Attach them to any equipment that moves including production machinery, lift trucks, switch engines, company cars or trucks. They record charts showing operating time and idle time of all equipment. With these records you can declare war on inefficiency!

Write for illustrated literature.

THE SERVICE RECORDER COMPANY
1013C ROCKWELL AVE., CLEVELAND 14, OHIO

Begins on page 272

operator's license with a few months of part-time study. Lots of books are available to prepare trained technicians for the required exams. And resident and correspondence schools offer special courses for FCC license examinations.

The basic equipment required for an in-plant radio maintenance shop for servicing all types of UHF, VHF, and HF equipment costs $3000 to $3500. But much of the more expensive equipment is unnecessary if you have only Class D CRS equipment, and standard quality instruments will be satisfactory. Equipment layout for such a shop will run only $500 to $750.

HOW TO GET STARTED

If your plant is relatively isolated, if your communications are across level terrain, and if noise problems are average, the information in the three tables on page 273 may be all you'll need. If this is not your situation, it may pay you to seek advice before you spend money. The experience of your industrial neighbors can be helpful.

If you have a smart ham radio operator on the staff, he may be able to size up your problem and come up with the best recommendation. Or you can lease some of the better MRS equipment. If your long-range plans are complex, it may even pay to hire a consultant.

Manufacturers of higher-priced equipment can help you plan a system. But you can't expect much free consulting service on equipment in the $100 bracket.

Licenses are free. You just file your application with the FCC. Most equipment manufacturers provide the prescribed forms and help customers fill them in.

To date, FCC has processed several hundred MRS licenses and over 55,000 CRS licenses (mostly Class D). It now takes about 10 weeks to process an application for an MRS license, 8 weeks for Class D. FCC says that delays result because applicants fail to show proper evidence of frequency coordination for MRS licenses, or fail to explain exactly how they intend to use the service for CRS permits. **END**

Top efficiency...Competitive costs
from
General Blower

NEW INDUSTRIAL FANS

AVAILABLE IN MULTIPLE WHEEL TYPES:
- HEAVY-DUTY
- RADIAL BLADED
- AIR
- MATERIAL HANDLING

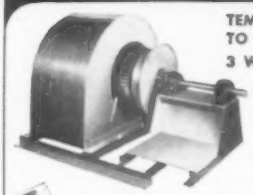
A type and design to serve any industrial application.
WRITE FOR BULLETIN IF-100

A GENERAL BLOWER "FIRST"!
Capacity tables to show mechanical and static efficiencies for each point of operation! Write for details.

General
TURBO-PRESSURE BLOWERS
4 Oz. to 3 Lbs. PRESSURE 80 C.F.M. to 10,000 C.F.M.

Costlesstooperate . . . Deliver higher C.F.M. for a given H.P. with higher maximum efficiency. Available with corrosion-resistant coatings or stainless alloys.
WRITE FOR BULLETIN TB-109

General
"DURA-TEMP" HEAT FANS
TEMPERATURES TO 1650° F
3 WHEEL TYPES



- FORWARD CURVE
- BACKWARD BLADE
- RADIAL ROTARY

GENERAL "DURA-TEMP" Heat Fans have acceptance by major kiln and industrial furnace manufacturers.
WRITE FOR BULLETIN HF-100

General
BACKWARD BLADE, NON-OVERLOADING CENTRIFUGAL FANS
688 C.F.M. to 122,560 C.F.M., ⅛" to 12" S.P.
WRITE FOR BULLETIN BB-105

General Blower Co.
SUBSIDIARY OF
ILG ELECTRIC VENTILATING CO.
DEPT. C, MORTON GROVE, ILLINOIS

"IF YOU WANT WATERPROOF TRUCKS AND TRAILERS WE RECOMMEND SOUTHERN ALUMINUM ROOF COATING"

—Raymond N. Barnes, Wilson Truck Company, Inc., Nashville, Tennessee

All Wilson trucks and trailers get regular applications of Southern Aluminum Roof Coating, made by **Southern Paint Products Co.**, Atlanta, Georgia. It's easy to apply.

Wilson Truck Company believes in delivering cool, dry cargoes. That's why they're so enthusiastic about Southern Aluminum Roof Coating, made with ALCOA® Pigments. But let Raymond N. Barnes, Superintendent of Maintenance, tell it:

"We've been using Southern Aluminum Coating for the past two years and we're sold. In fact, it has done a better job than you said it would at the time of your first sale. It has eliminated our leaky roof problem. It's very easy to apply and it gives a clean, bright finish."

And Wilson cargoes are cooler in summer. The reflective aluminum roof surface turns back 70 per cent of the radiant heat that strikes it, reduces inside temperatures as much as 15 degrees. Once applied, a coating like *Southern* stays firm on top, soft and pliant underneath—no sag in summer or cracks in winter.

Easy to apply with ordinary roofing brush, Southern Aluminum Coating comes ready mixed... requires no thinning or heating. The finish stays attractive for years. Better ask your motor maintenance man what he's using. If it's not aluminum, you may have problems.

ALCOA does not make aluminum roof coatings, but we will be happy to refer you to reputable manufacturers who do. Send today for our booklets, *Painting With Aluminum* and *Aluminum Roof Coatings Make Time Stand Still.* Use the coupon.

PIGMENTED WITH ALCOA ALUMINUM

Look for this label . . . it's your guide to the best in aluminum value

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC TV.

Aluminum Company of America
1739-J Alcoa Building, Pittsburgh 19, Pa.

Please send your free booklets:

- ☐ *Painting With Aluminum*
- ☐ *Aluminum Roof Coatings Make Time Stand Still*

Name_____

Company_____

Address_____

City_____ Zone___ State_____

THIS IS THE WAY

(THE MAGLINER WAY)

You name the loading job—there's a Magliner to solve it the cost saving way! Magliner Dock Boards for truck or rail . . . Dock Extensions . . . Mobile Loading Ramps . . . Delivery Truck Ramps. Magliners do a big job for many companies, and can do the same for you . . . moving your loads between dock and carrier for less money than it's costing you now! *Get all the facts!*

WRITE FOR BULLETIN DB-204
MAGLINE INC.
P. O. Box 219
Pinconning, Michigan

Magliner MAGNESIUM
DOCK BOARDS
LOADING RAMPS

294 **Circle 645 on Reader Service Card**

ADVERTISERS' LITERATURE

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

ELECTRICAL

346—Silicones. Complete data on uses for insulating motors and other electrical equipment. Dow Corning Corp.

347—Switches. Catalogs 83 and 84 give information on explosion-proof switches. Micro Switch Div., Honeywell.

348—Electrical Cord, Cable. Full data and structural features for varied uses. Western Insulated Wire Co.

349—Lighting. New data-packed 20-page picture paper, "Facts of Light." Lamp Dept., General Electric Co.

350—Rectifiers. Here's a free guide to the selection of metallic rectifier equipment. Sel-Rex Corp.

351—Starters. Bulletin 14-B1 gives complete data on magnetic starters through 400 hp. Furnas Electric Co.

352—Fuses. Bulletins FIS on dual-element, HCS on high-capacity fuses 0 to 600 amp. plus. Bussmann Mfg. Co.

353—Motors. Bulletin PB 6000-2 gives specific data on complete line of sealed motors. Elliott Co.

354—Motor Starters. Bulletin SM-275 gives story featuring one-piece thermal overload relays. Square D Co.

PRODUCTION

355—Nut-Running Tools. Catalog 30-A, standard and magnetic, ¼- to ⅝-in. square drive. Apex Machine & Tool Co.

356—Schedule Board. Bulletin X-500 shows application of visual control schedule board. Graphic Systems.

357—Masking Tape. Full information on extra-strong paper masking tape for varied applications. Shuford Mills.

358—Screwdriving Tools. Catalog 30-C, complete line of standard and magnetic types. Apex Machine & Tool Co.

359—Air-Power Devices. Idea file contains installation data, wiring diagrams, equipment lists. The Bellows Co.

360—Filters. Technical literature, engineering help on hydraulic bulk-type filters. Commercial Filters Corp.

361—Reproduction Materials. Free copy of a booklet on Kodagraph reproduction materials. Eastman Kodak Co.

362—Temperature Control. Data sheets on thermoswitch units for temperature control processing. Fenwal, Inc.

363—Nut-Running Tools. Catalog 30-B, standard and magnetic, ¾- to 3½-in. square drive. Apex Machine & Tool Co.

364—Finishing Systems. Catalog A-659 gives details, describes representative installations. R. C. Mahon Co.

365—Socket Head Cap Screws. Brochure gives dimensional, design data on 1960 series. Standard Screw Co.

366—Heat Exchangers. New bulletin (P-60) gives specifications, data, and applications. Tranter Mfg., Inc.

367—Fastening Tools. Catalog 30-D lists line of miscellaneous fastening tools. Apex Machine & Tool Co.

368—Electric Heaters. Catalog 60 provides detailed product information, varied applications. E. L. Wiegand Co.

369—Photo Panels. Complete information in literature on unique recording system. Acme Visible Records.

370—Tachometer. Catalog 148-H gives complete data on line. Speeds, 50 to 50,000 rpm. Jones Motorola Corp.

371—Clutches. Bulletin 226-M describes features of new small-size, high-torque disk clutch. Stearns Electric Corp.

372—Marking Devices. Technical bulletins on specific marking, stamping, stenciling problems. Speedry Products.

373—Metal Lathes. Catalog describes new 10-in. lathe plus complete line and accessories. Rockwell Mfg. Co.

374—Gears, Speed Reducers. Catalogs Nos. 55 and 57 give complete data on full line. Horsburgh & Scott Co.

375—Head Cylinders. Bulletin SQ 10-58 gives full data on new square-head cylinder. Tomkins-Johnson Co.

376—Spray Gun Pumps. Bulletins supply complete data on air-operated spray paint pumps. Binks Mfg. Co.

377—Electrostatic Hand Gun. Literature gives details of new painting tool. Ransburg Electro-Coating Corp.

378—Hose Reels. Technical data and folder describes time- and cost-saving features. The Wayne Pump Co.

Turn the page

PERMACEL Paper Tapes—available with a wide range of characteristics, for masking, protecting, splicing, bundling, drafting, labeling, packaging, sealing.

whatever the job . . .

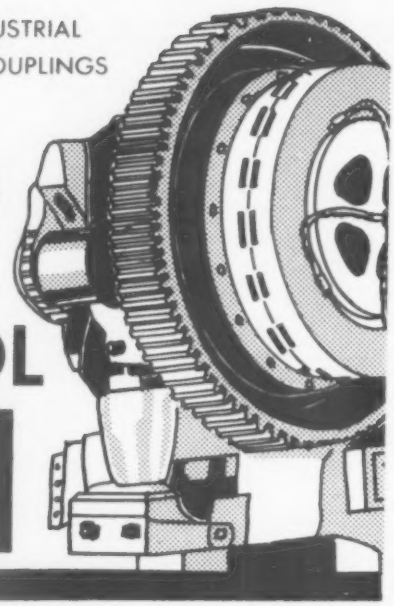
PERMACEL®

PERMACEL *New Brunswick, N. J.* TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES

For more facts Circle 646 on Reader Service Card

Roylyn INDUSTRIAL COUPLINGS

KEEP the wheels of industry COOL



ALL PURPOSE *Industrial "Quick"* **COUPLINGS**

The mighty machines of American industry "keep cool" with lines connected quickly and easily with Roylyn Industrial Couplings. Too, the fluids that nourish these machines pass through these popular couplings from tank to tank car to truck to user.

IMPORTANT FEATURES

Quick Connecting	Increased Efficiency
Full Flow	Economical
Ease of Operation	Vibration Proof
Positive Lock	Minimum Maintenance
Rugged Construction	Maximum Efficiency
Open and Self-Sealing	Adaptability between
High Pressure Seal	Like Sizes
Longer Life	Sizes from ¼" to 3"

Open

INDUSTRIAL APPLICATIONS

Hydraulic Test Stands	Rolling Mills
Pulp and Paper Mills	Annealing Plants
Soap Industry	Petroleum
Sugar Refineries	Petro-chemical
Public Utilities	Canneries

Self-Sealing

. . . and many other applications requiring fast, safe and sure "quick" couplings.

The Best Connections in the World

DESIGNED • MARKETED BY AIRATERRA

620 PAULA AVENUE • GLENDALE 1, CALIFORNIA

For more facts Circle 647 on Reader Service Card

ADVERTISERS' LITERATURE

Begins on page 294

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

379—Chains, Sprockets. Comprehensive Catalog 1050 gives complete data and features. Link-Belt Co.

380—Air Cylinders. Full information on line of air cylinders, valves, and accessories. A. Schrader's Son.

381—Flexible Hose. Describes features and applications of new Springfield "400" Teflon hose. Titeflex, Inc.

382—Sheaves. 100-page multi-V-drive manual for selection of right sheave and V-belt. Worthington Corp.

383—Modular Work Stations. Bulletin 158 covers adaptable custom-planned layouts. Products for Industry.

STORAGE, CONTAINERS

384—Metal Lumber. Complete details on slotted metal framing available on request. Republic Steel Corp.

385—Paper Packaging Bags. Booklet (CP-1) describes dozens of ways to cut costs. Union Bag-Camp Paper Corp.

386—Stacking Boxes. Here's full information on design features for varied applications. Republic Steel Corp.

387—Drawers. Catalog 302 (32 pages) shows complete and extensive line of drawer and drawer units. Equipto.

388—Bar Racks. Full information on unit 78 in. high, 36 wide, 33 deep at the base. Republic Steel Corp.

MAINTENANCE

389—Floor Wax Cleaner. Literature describes neutral liquid soap with a wax base. Finnell System, Inc.

390—Floor Sweeper. Illustrated bulletin covers new walk-behind electric floor sweeper. G. H. Tennant Co.

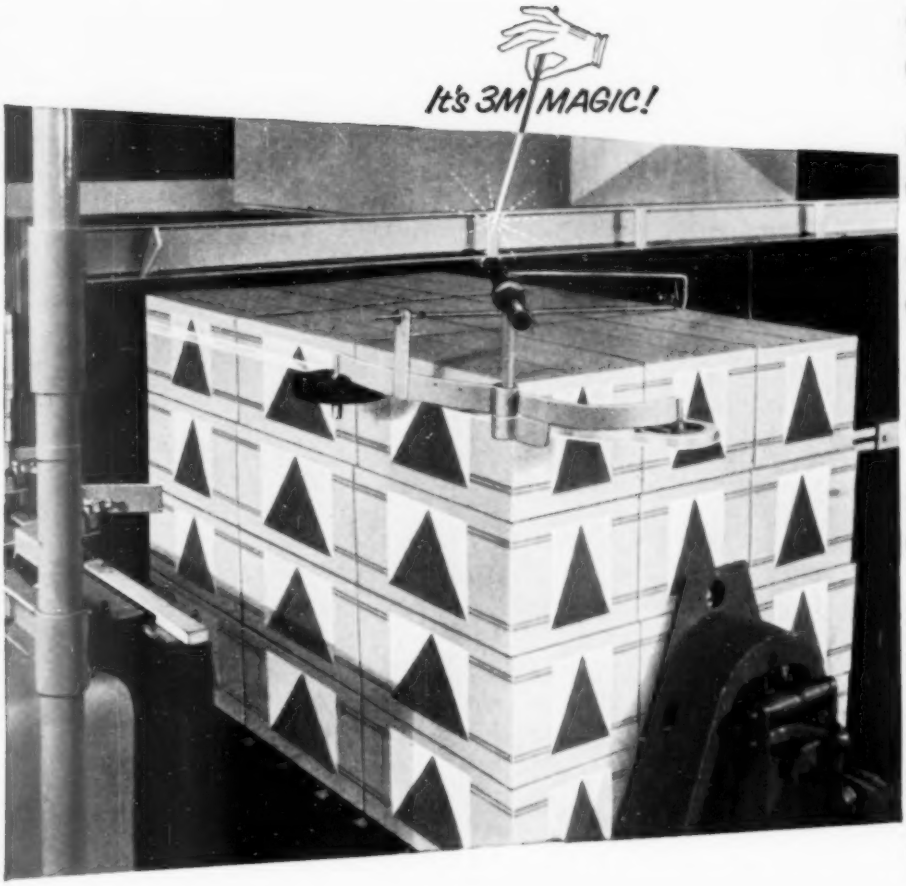
391—Gaskets. Free catalog gives information on complete line of sealing flange gaskets. Parker Seal Co.

392—Aerosols. Free handbook with 45 self-spraying maintenance and production aids. Sprayon Products, Inc.

393—Vacuum Cleaners. Catalog 155B describes line of cleaners (1½ to 15 hp.). Spencer Turbine Co.

394—Paint. Paint selection checkchart for practically every maintenance problem encountered. Wilbur & Williams Co.

Turn the page



SCOTCH BRAND
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TAPEnology takes over stack unitizing for new automatic Pallet Loader

A new automatic Pallet Loader, developed by Lathrop-Paulson Co., Chicago, now permits stacking and palletizing of shipping cases and cartons at a rate of 15-30 per minute. What's more, it also automatically unitizes the top layer of each pallet with a single band of super-strong "SCOTCH" Brand Filament Tape... thus assuring maximum load stability without the necessity of interlocking the stack pattern.

Tight-holding "SCOTCH" Brand Filament Tape sticks at a touch; unwinds easily for automatic application; holds firmly with a strength of up to 500 lbs. per inch of tape width. And tape won't cut into or damage cartons; is easily disposed of when no longer needed.

What do you ship? "SCOTCH" Brand Filament Tape offers dozens of time- and cost-saving shortcuts in holding, bundling, carton reinforcing and unitizing. Chances are, 3M Customer Engineering Service can show you how to utilize "3M-MATIC" Taping and Dispensing methods to get the economies of machine application. Ask your "SCOTCH" Brand Tape Distributor for information, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. IAE-99.

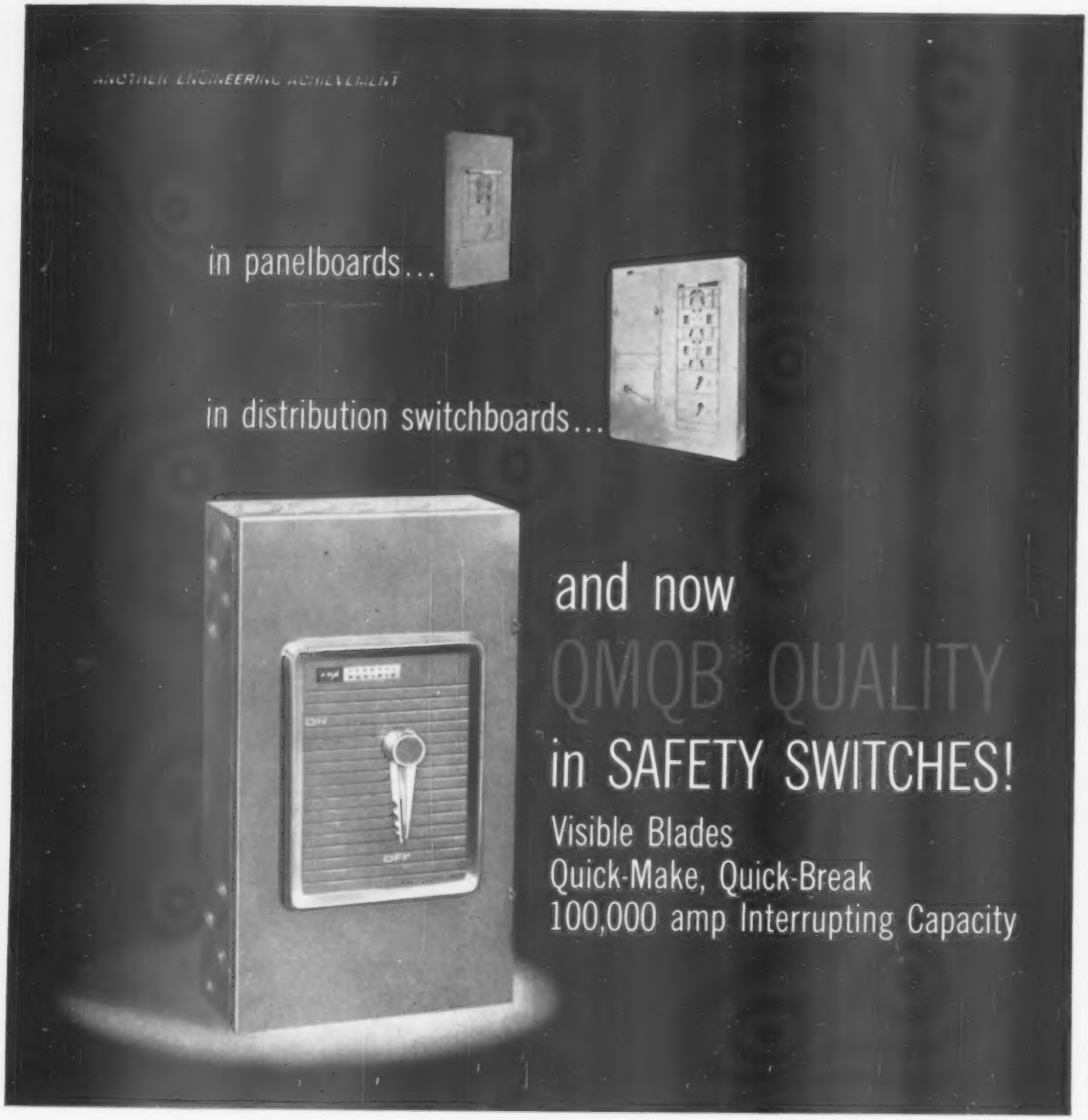
When tape costs so little, why take less than "SCOTCH" Brand?

"SCOTCH" is a registered trademark for the pressure-sensitive adhesive tapes of 3M Co., St. Paul 6, Minn. Export: 99 Park Ave., New York 16. Canada: London, Ontario.

MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

For more facts Circle 648 on Reader Service Card



* QUICK-MAKE, QUICK-BREAK ACTION—QMQB Safety Switches are tease-proof! Once handle passes midpoint, QMQB mechanism takes over—drives contacts home quickly and accurately in less than one cycle. Longer contact life...cleaner contacts...positive connections...cooler, more reliable performance.

■ 400 amp THROUGH 1200 amp—Normally assembled to take single fuses on 400 amp and 600 amp ratings...parallel 400 amp fuses on 800 amp switch...parallel 600 amp fuses on 1200 amp switches. Available soon —800 amp and 1200 amp ratings designed for single fusing.

■ VISIBLE BLADES FOR MAXIMUM SAFETY—Eliminates any doubt as to whether switch is "ON" or "OFF" and provides for easy inspection.

■ LEVER-TYPE HANDLE ACTION FOR EASY SWITCH OPERATION—Requires less than 60° throw to operate interlock and switch mechanism. For added safety: large, rugged handle indicates switch position...can be clearly seen from a distance.

■ DEIONIZING ARC QUENCHERS FOR COOLER, FASTER INTERRUPTION—Arc is drawn from contact...broken into segments by grids...cooled and extinguished before any damage can be done.

■ HIGH PRESSURE FUSE CLIPS FOR LONG LIFE, DEPENDABLE SERVICE —Belleville washers apply constant pressure against the fuse and hold it in a vise-like grip. Low resistance contact...cooler, more efficient operation.

Now...by applying its proven QMQB concept to heavy duty safety switches ...Federal Pacific makes a major advance in the economical handling of Industry's increased power requirements. For complete details of QMQB Safety Switches write for Bulletin #1280, Federal Pacific Electric Company, General Offices: Dept. 371, Newark 1, New Jersey.

FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment

For more facts Circle 649 on Reader Service Card

FACTORY

ADVERTISERS' LITERATURE

Begins on page 294

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

395—Machine Mounts. Consolidated facts bulletin gives information on varied types. Unisorb Div., Felters Co.

396—Paint. Full information and color chips in five attractive colors free upon request. Valdura Paint Div.

397—Ladders. Complete information on "Hi-boy" ladders with exclusive pyramid design. Ballymore Co.

398—Fire-Retardant Paint. Data on dual-purpose fire protection and maintenance program. Albi Mfg. Co.

399—Paint. "Quick Reference Guide" for selection of paint for controlling costs. Barreled Sunlight Paint Co.

400—Sanitary Chemicals. New technical brochure, "Engineered Maintenance," on sanitation. Puritan Chemical Co.

401—Rustproofing Paints. Complete literature available, with applications and color charts. Rust-Oleum Corp.

402—Paint. Booklet, "How to Put Color to Work"; plan of Color Conditioning. E. I. du Pont de Nemours & Co.

403—Fire-Retardant Paints. Illustrated descriptive literature and technical data to help you. Alim Corp.

MATERIAL HANDLING

404—Lift Trucks. Booklet explains leasing plan for lift trucks with rate tables. Elwell-Parker Electric Co.

405—Walkie Pallet Trucks. Bulletins provide full information on walkie pallet trucks. The Raymond Corp.

406—Batteries. Book describes new active material for longer battery life. Edison Storage Battery Div.

407—Tractor-Shovels. Complete data on features of new 5000-lb. capacity front-end loader. Frank G. Hough Co.

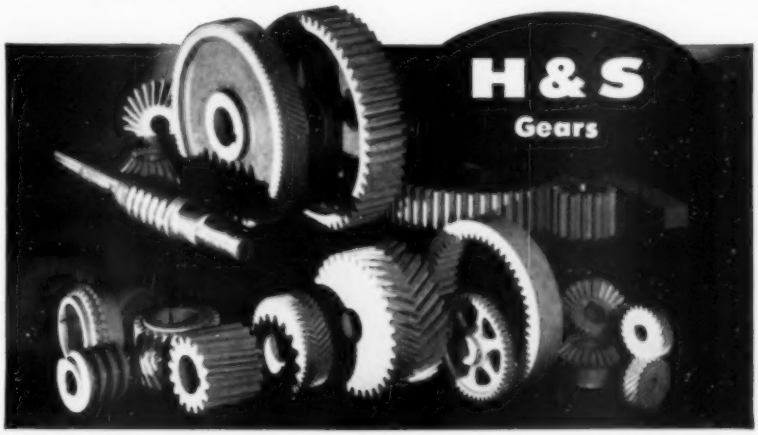
408—Walkie Pallet Stacker. Bulletin gives data on 2000-lb.-capacity walkie pallet stacker. The Raymond Corp.

409—Hoists. New Catalog H-59 gives details and features of heavy-duty hoist. American Engineering Co.

410—Tramrail Systems. Engineering and Data Booklet 2008 has useful data. Illustrated. Cleveland Tramrail Div.

Turn the page

Gears and Speed Reducers
for your power transmission needs



H & S offers a complete line of Speed Reducers. Single, double and triple reduction types using Herringbone and Helical gears provide ratios from 2.31 to 1 up to 429 to 1; Worm gear reducers' ratios range from 3.56 to 1 up to 10,000 to 1. H & S has also become a leader in engineering and building special drives with space- and cost-saving features.

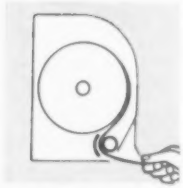
Industrial Gears, large or small, backed by over 70 years experience: Spur Gears up to 160" dia.; Spur Racks up to 12 ft. long; Helical Gears up to 125" dia.; Sykes Herringbone, up to 60"; Straight Bevel, up to 77"; Worm Gears up to 60" dia.; Sprockets, up to 48" dia. H & S Gears are available in Steel, Cast Iron, Ductile Iron, Bronze, Rawhide, Fibroil, or Bakelite.

Send for Speed Reducer Catalog No. 55, Gear Catalog No. 57.

THE HORSBURGH & SCOTT CO.
GEARS AND SPEED REDUCERS
5112 Hamilton Avenue • Cleveland 14, Ohio

Steiner controlled towel dispensers

Cut washroom costs three ways



HOW IT WORKS: Towels are in roll. User pulls towel down and tears up. Control mechanism turns roll so another towel is ready for next user. Result: every user gets enough towels but there is no waste.

First: You'll save with Steiner Company controlled paper towel dispensers because *controlled* dispensing cuts towel waste . . . as much as 20 per cent. Second: You'll reduce washroom maintenance costs because cabinet holds about 500 towels . . . coupled with waste cutting, this means supply lasts longer and cabinet has to be refilled less frequently. Third: You can reduce your inventory and free valuable storage space for other supplies. Reason: A case of Steiner roll towels is the same size as a case of folded . . . yet it holds twice as many towels.

Your local janitorial supplier or sanitary paper distributor can help you . . . there is no charge for the dispensers. For free literature please write to Steiner Company, 740 Rush St., Chicago 11, Ill.

STEINER

STEINER COMPANY

740 RUSH STREET. Dept. B-9. CHICAGO 11. ILLINOIS

For more facts Circle 651 on Reader Service Card

ADVERTISERS' LITERATURE

Begins on page 294

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

411—Portable Elevating Table. Bulletin describes 2000-lb.-capacity elevating table. The Raymond Corp.

412—Fir Plywood. Information on properties, uses with cost-saving advantages. Douglas Fir Plywood Assn.

413—Steel Pallet Racks. Complete data, structural features, and uses for varied products. Republic Steel Corp.

414—Lift Truck Drives. Booklet describes new instant foot-controlled power application. Towmotor Corp.

415—Electric Truckster. Illustrated literature on new Model 734 heavy-duty truckster. Cushman Motors.

416—Scales. Bulletin 2970 gives full descriptive data on new electronic load cell scales. Toledo Scale Div.

417—Marking Systems. Bulletin on "assembly-line" addressing systems gives full data. Weber Marking Systems.

418—Hoists. Bulletin H-20 gives facts and features of precision operating hoist. Harnischfeger Corp.

419—Time Recorders. Literature describes use on lift trucks to record operating time. Service Recorder Co.

420—Lift Trucks. Illustrated brochure gives full data on new Monotrol control system upon request. Hyster Co.

421—Trolley Conveyors. Book 2330 gives complete data and shows specific applications. Link-Belt Co.

422—Cranes. Bulletin C-51 gives details on low-cost, 5-speed standard-built cranes. Harnischfeger Corp.

423—Magnets. Facts on permanent non-electric magnets for tramp and fine-iron separation. Eriez Mfg. Co.

PLANT SERVICES

424—Compressors. Free Bulletin 301-12 gives full details on complete line of compressors. Joy Mfg. Co.

425—Washroom Service. Free 32-page booklet gives facts on washroom advisory service. Scott Paper Co.

426—Fans, Ventilators. Bulletins DS-348-F; DS-348-B; DS-348-U; DS-348-D; DS-364-A; DS-364-C. The Trane Co.

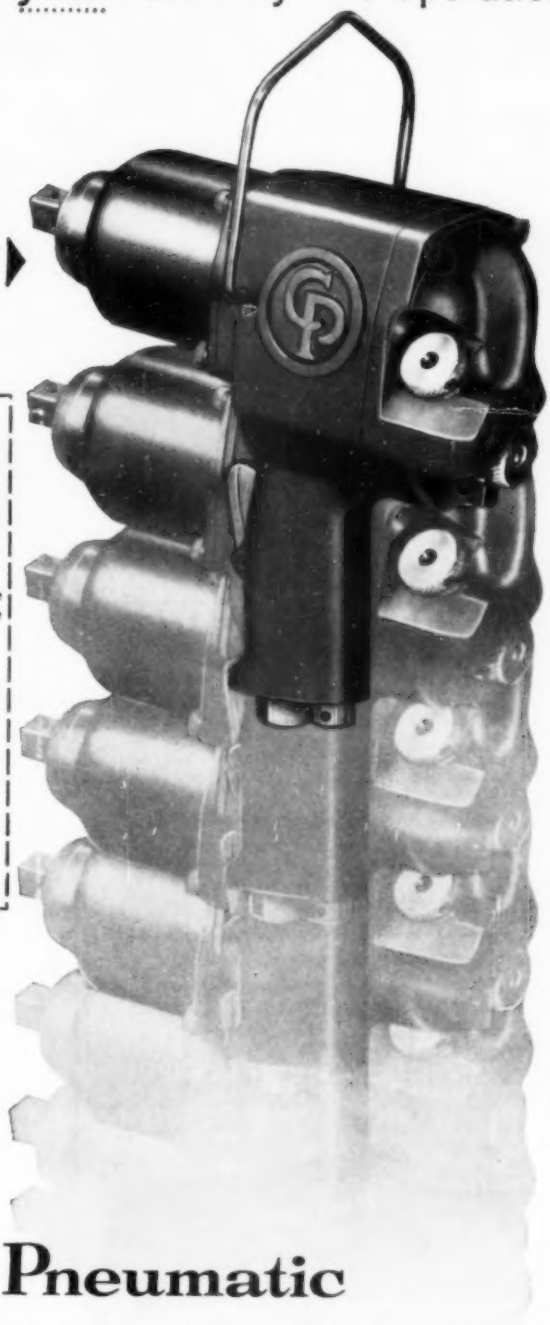
Turn the page

FACTORY

don't underestimate the importance of

PROPER BOLT TIGHTNESS

in your assembly line operations!



CP-3440-TS adjustable torque range 15 to 80 ft-lbs. ½" square drive.

TORQUE CONTROL IMPACT WRENCHES

CP-3630-RTP adjustable torque range 100 to 350 ft-lbs. ¾" or 1" square drive.

CP-610-RTP adjustable torque range 300 to 600 ft-lbs. 1" square drive.

✻ A complete line of Torque Control Screwdrivers and Nutrunners solve other threaded fastener torque problems. Available from No. 4 screw size to ⅜" bolt size.

More and more top-flight manufacturers are realizing that *proper bolt tightness* is a quality factor that gives them a sales edge over competitive products . . . their assembly line foremen know that the use of TORQUE CONTROL IMPACT WRENCHES in the driving of nuts and bolts to "correct torque" means:

- Less work spoilage
- No chance of sheared bolts or stripped threads
- Inexperienced operators learn nut running operations faster
- Less product failure

CP Torque Control Impact Wrenches give you the exact tightness you want in a fast, accurate, "one-shot" rundown that doesn't require a hand torquing follow-up to check work accuracy. Torque ranges from 15 to 600 foot pounds available.

Let a CP Fastener Specialist work with you on your problems. You'll be impressed by the easy handling qualities of these unusually compact tools. The torque control mechanism is totally enclosed and *all torque adjustments* are made quickly AND simply without special tools or fixtures. For further information, contact your nearest CP Office, or write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Extra-high strength masking tape

SHUFORD'S SHURTAPE® RP-52

Shuford's SHURTAPE RP-52 is a paper masking tape that meets all the requirements for heavy duty use.

This pressure-sensitive tape with rubber impregnated rope paper backing has extra-high strength, low tack and superior resistance to abrasion.

Use it on anodized or allodized metal surfaces, rubber and plastics or on chemically treated surfaces where corrosive conditions exist. Withstands temperatures to 300°F for one hour periods . . . still strips clean. Also available in high tack (RP-59) for more conventional applications.

Order Shuford's SHURTAPE RP-52 for heavy duty use in your plant.

Write for full information to

CLOTHES LINES • TWINES
PRESSURE-SENSITIVE PAPER TAPES
SASH CORDS • WEATHER STRIPPING
COTTON & RAYON YARNS • EXTRUDED PLASTICS

Shuford SINCE 1880 Mills, INC
HICKORY, N. C.

4239 **World's Largest Manufacturer of Cotton Cordage**

302 **For more facts Circle 653 on Reader Service Card**

ADVERTISERS' LITERATURE

Begins on page 294

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

427—Lighting. Free brochure explains advantages of Eye-Fi Relighting. National Lighting Bureau.

428—Compressed Air Dryers. Brochure with charts describes complete line. One to 6000 cfm. Van Products Co.

429—Industrial TV Camera. Planning book describes new all-transistor TV camera for industry. Philco Corp.

430—Towel Dispensers. Free literature gives full information on controlled towel dispensers. Steiner Co.

431—Aftercoolers, Separators. Bulletin 712 on air equipment and Bulletin 117 on air filters. R. P. Adams Co.

432—Steel Equipment. Catalog lists and illustrates diversified line of equipment. Lyon Metal Products, Inc.

433—Snow Melting Systems. Booklet covers installation, operation, costs of system. The National Supply Co.

BUILDINGS

434—Plastic Panels. Literature on new plastic panels. Shatter-proof, non-corrosive. Butler Mfg. Co.

435—Unit Heaters. Information on full line of unit heaters to fit varied applications. Carrier Corp.

436—Corrugated Transite. Free 32-page brochure, "Corrugated Asbestos Transite" gives full data. Johns-Manville.

437—Rolling Doors. Information on motor, mechanical, or manually operated rolling doors. Kinnear Mfg. Co.

438—Floor Plate. Bulletin SD-N10 gives detailed information and structural features. Alan Wood Steel Co.

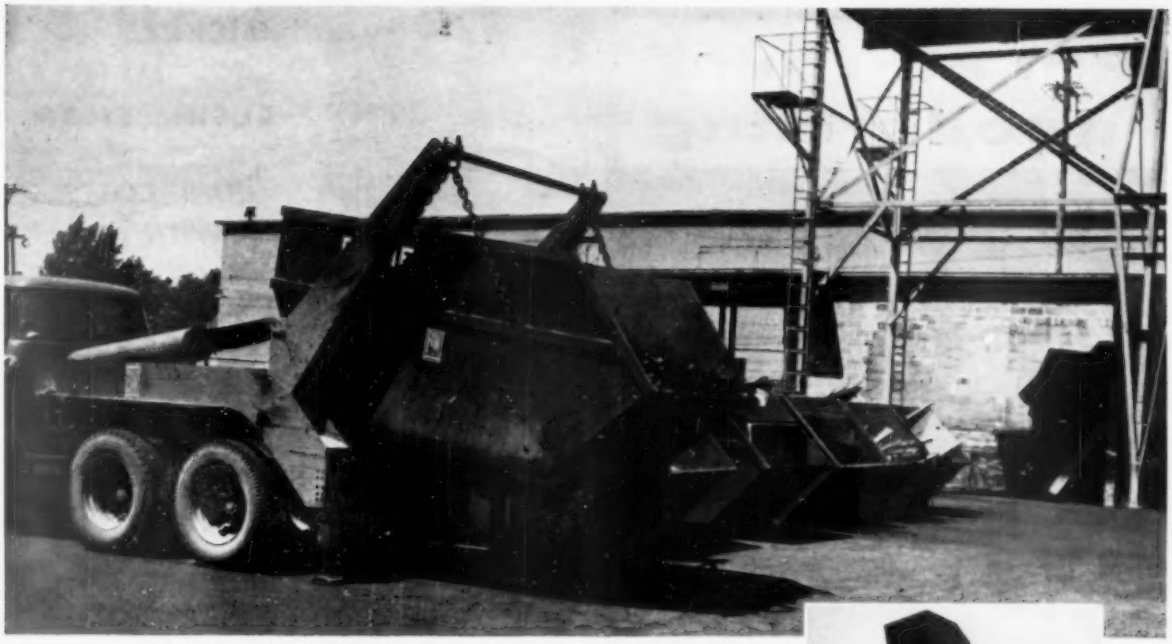
439—Window Panes. Complete details on weather-resistant plastic flat window panes reinforced. Johns-Manville.

440—Floor Gratings. New catalogs give complete details of revolutionary new gratings. The Globe Co.

441—Glass-Fiber Panels. New glazing folder and specific case history give complete facts. Structoglas Div.

442—Plant Sites. Analyzes industrial potential for locating plants. Bristol (Va.) Industrial Development Board.

443—Hardboard Panels. Booklet gives comprehensive checklist of money-saving suggestions. Masonite Corp.



Clean, orderly scrap collection areas like this are provided by The Load Lugger System.

Good Housekeeping doesn't cost - - it pays!

Neat, orderly premises pay off in greater plant efficiency, safer operating conditions, better employee morale—as good plant operating men know.

THE LOAD LUGGER SYSTEM can reduce your plant housekeeping costs as much as one-half. Big Load Lugger containers* spotted in scrap collection areas, at rubbish accumulation points and adjacent to the plant cafeteria eliminate drums, boxes, messy garbage pails, and the cost of several men to handle them. One man and a Load Lugger truck can do the job in a fraction of the time. One truck can service scores of containers.

Many industrial plants and commercial institutions are getting good housekeeping results with the versatile Load Lugger system, and at less than the cost of other methods. Why not draw on our experience in solving their housekeeping problems? We'll make practical recommendations. You've everything to gain, nothing to lose. WRITE TODAY.

*Capacities 1½ to 16 cubic yards.

Load Lugger truck dumps big container at disposal site. Container will be returned to its station for refilling. One truck, one man, accomplish more than a dozen trucks and men can by other methods.

This leak-proof, vermin-proof container simplifies garbage and refuse disposal at a plant cafeteria, keeps litter from being blown about.

INGERSOLL KALAMAZOO B-W BORG-WARNER

Borg-Warner Corporation

INGERSOLL KALAMAZOO DIVISION

1829 North Pitcher Street, Kalamazoo, Michigan, Telephone Fireside 5-3501

EXPORT SALES: BORG-WARNER INTERNATIONAL CORPORATION, CHICAGO

ASK ABOUT OUR LEASING AND FINANCING PLANS

For more facts Circle 654 on Reader Service Card

For all-'round deodorizing

Fragrant, laborless deodorant discs for urinals, bowls, garbage pails, lockers, closets

Deodoroma ROUNDS cost in use averages only a *fraction* of one cent a day. Rounds are formed under 70,000 pounds pressure: are dense and durable. Fragrance is locked in: lasts until the last particle has vaporized — there's no harsh "moth cake odor." Packed eight to the telescoping box — each Round sealed airtight — easy-to-shape Holzit wire holder in every box. For literature write to The C. B. Dolge Company, Westport, Conn.

For free sanitary survey of your premises ask your Dolge service man

dependable DOLGE
WESTPORT, CONNECTICUT

For more facts Circle 655 on Reader Service Card

MICKEY MANTLE, BUSINESSMAN,

CUTS COSTS WITH A

Clarke

"Our new Clarke Power Sweeper saves hours and hours of expensive, slow hand sweeping," says Mickey Mantle at his Holiday Inn, Joplin, Mo. Mickey's Clarke ERS-36, newest rider-type power sweeper effectively cleans the 489 ft. x 865 ft. area twice a week in 14 hrs.—averaging 60,000 sq. ft. per hour. In addition, Mickey reports, "Guests compliment the clean, neat appearance of the driveways." Ask your Clarke distributor for an on-the-job demonstration. Write for details.

Clarke
FLOOR MACHINE CO.
Formerly Clarke Sanding Machine Company

769 E. Clay Ave., Muskegon, Mich.
Authorized Sales Representatives and Service Branches in Principal Cities
In Canada: Clarke Floor Machine Company (Canada), Ltd., 21 Advance Rd., Toronto 18, Ontario

For more facts Circle 656 on Reader Service Card

JONES #3200

Hand Tachometer

BROAD RANGE
50 — 5,000 R.P.M.
with stop button

assures better production

HIGHER OUTPUT — QUALITY CONTROL obtained by maintaining proper machine speeds. Also helps avoid breakdowns by detecting irregularities.

CARRY IT FROM JOB TO JOB and keep it handy for quick, accurate tests. Choice of readings in R.P.M., F.P.M., etc.

GUARANTEED ACCURACY—superior construction, trouble-free. Unaffected by moisture, temperatures, electric currents.

Many other Portable and Stationary Models, indicating Speeds between 50 R.P.M. and 50,000 R.P.M., are available.

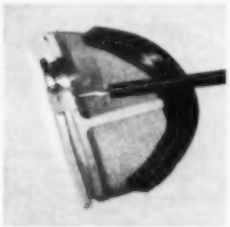
Write for catalog 148-H

JONES MOTROLA CORP.
Stamford, Conn.

For more facts Circle 657 on Reader Service Card

**PROTECTION PLUS*
by BAUSCH & LOMB**

Wire mesh side shield has fine screen to stop particles and give ample air flow.



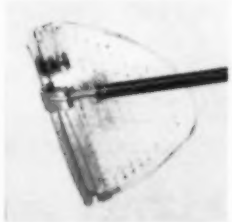
Insulated wire mesh side shield with heat-resistant covering. Non-corroding.

NEW M-70 Metal Frame Safety Glasses

M-70 The basic B&L metal frame safety glass.

P-71 The M-70 with wire mesh side shields.

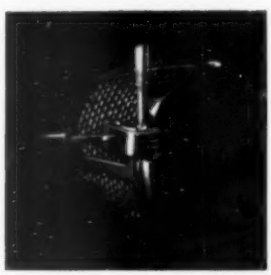
Side shield of solid acetate stops passage of liquids and dust. In clear or green.



Perforated acetate side shield provides protection plus comfort. In clear or green.

Job-Tailored!

Fitting the protection to the hazard is half the battle. Now you do it easily and swiftly in your own department with a single basic front and a selection of side shields. M-70 combines the sturdiest metal construction with distinctive styling and new Bal-SAFE S-7 lens shape. Another striking example of the economy of Bausch & Lomb quality. Write for Catalog Folder A-1800: Bausch & Lomb Optical Co., 90145 Smith Street, Rochester 2, New York.

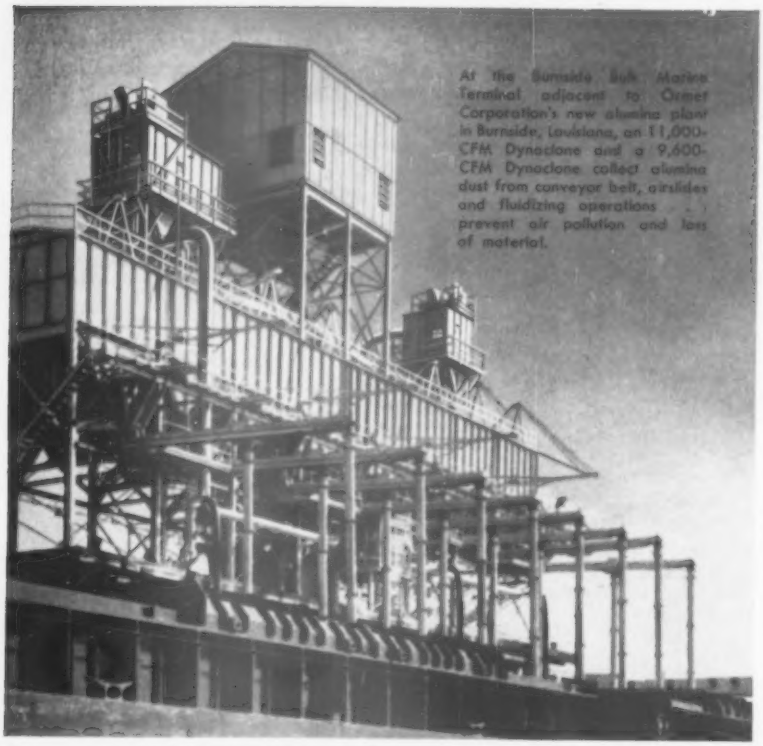


Ingenious expansion end piece does the trick . . . allows easy assembly and disassembly of side shields without changing fronts or temples.

BAUSCH & LOMB

*Protection PLUS Safety Products
protection + economy + worker acceptance

For more facts Circle 658 on Reader Service Card


At the Burnside Bulk Marine Terminal adjacent to Ormet Corporation's new alumina plant in Burnside, Louisiana, an 11,000-CFM Dynaclone and a 9,600-CFM Dynaclone collect alumina dust from conveyor belt, airslides and fluidizing operations . . . prevent air pollution and loss of material.

Constant Suction! Complete Collection!

SLY DYNACLONE®

The Dust Filter for Continuous Processes

Just turn this dust filter on and forget it. The Dynaclone operates continuously, 24 hours a day. It maintains constant, uniform suction at dust sources, reclaims all the dust to prevent air pollution and damage to plant equipment.

The Dynaclone has *new* "Resist-O-Wear" filter bags (patent pending) that give as much as three times longer bag life . . .

It has a new roller cleaner for simplified automatic self-cleaning. Resilient rubber rolls form a positive dust seal as each row of bags is cleaned by atmospheric air drawn in by the main operating fan.

And it contains more cloth per cubic foot of filter than any other make . . . greater filtering capacity with smaller space requirements.

Learn the many reasons why the Dynaclone represents a new high in dust filter efficiency . . .

Send for 36-Page Catalog 104

SEE THE DYNACLONE in Space 73, the Chemical Show, New York Coliseum, Nov. 30-Dec. 4

SINCE 1876 SLY

THE W. W. SLY MANUFACTURING CO.

4755 TRAIN AVENUE • CLEVELAND 1, OHIO
OFFICES IN PRINCIPAL CITIES

OVERSEAS LICENSEE: ANDREW AIR CONDITIONING LTD., LONDON S.W. 1, ENGLAND

For more facts Circle 659 on Reader Service Card

Manufacturing Men & Engineers "One Place" To Get The Answers!

The New . . .
ALDEN SYSTEMS HANDBOOK

Whether it's parts handling at the work place . . . setting up a stock room . . . running a power line . . . lighting a factory . . . operating in less space . . . or setting up an entire production line you'll find the answer in the new **Alden Systems Handbook** . . . 56 pages packed with "money saving" ideas on production . . . articles . . . case histories . . . problem solutions . . . cataloging and prices and the complete Alden Work Center System Story.

WRITE TODAY FOR YOUR FREE COPY

ALDEN SYSTEMS COMPANY
ALDEN RESEARCH CENTER
P. O. Box 125, WESTBORO, MASS.

Circle 660 on Reader Service Card

Remember!

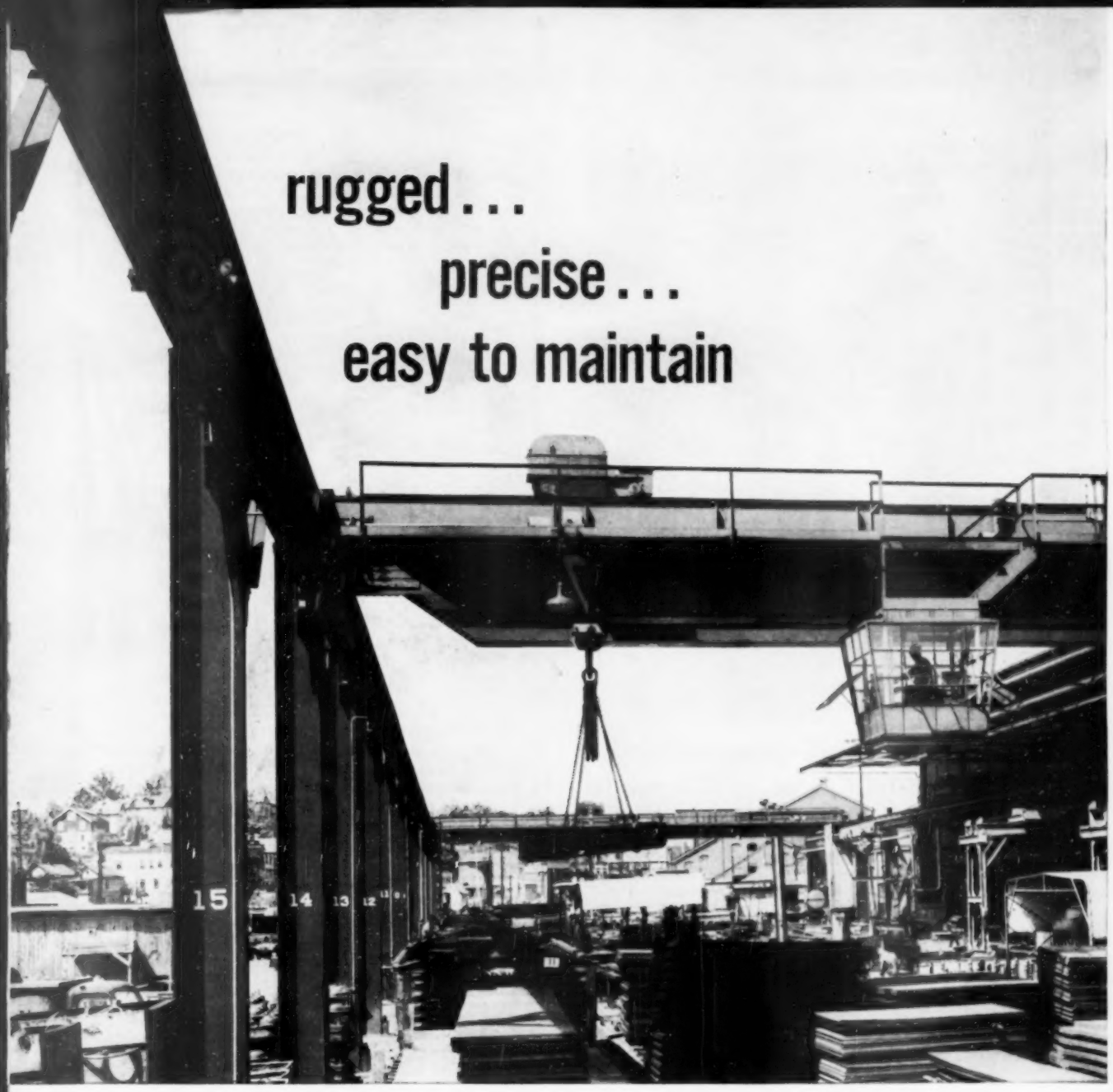
PALMETTO® *Packings*

– pack more performance into every application

GET THEM at any industrial distributor authorized to carry Palmetto Packings . . . For the name of a supply house near you consult our insert in Thomas Register—between pages 4816-4817.

GREENE, TWEED & CO.
North Wales • Pennsylvania

Circle 661 on Reader Service Card



Westinghouse crane control

Precision built to crane-duty standards . . . long-term, low-cost service with easy operation and low maintenance costs . . . the most complete line of magnetic crane control available . . . 'round-the-clock service facilities in all areas . . . all components service-proved . . . undivided responsibility from one supplier . . . just several of the reasons why you can count on dependable, more economical service from cranes equipped with Westinghouse control. Your nearby Westinghouse salesman has all the cost-saving facts. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22145

Photo above shows material bay of main carshop of Norfolk and Western Railway in Roanoke, Virginia, in which operate two twenty-five ton Whiting cranes, equipped with Westinghouse Load-O-Matic* a-c control systems, handling heavy plate and other material for car-manufacturing operation. Westinghouse Load-O-Matic crane control is ideal for applications requiring unusual stamina, ease of operation and low maintenance cost. Provides smooth, stepless speed control without the cost and complexity of d-c conversion equipment. *Trade-Mark

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

For more facts Circle 662 on Reader Service Card

IDEA! "Our wash fountain area is safer now with 'SCOTCH-TRED'!"
IDEA! "Our cloth cutting-room floors aren't slippery now. 'SCOTCH-TRED' gives a comfortable, safe footing!"

Everybody's talking about "SCOTCH-TRED"... the new IDEA material for greater efficiency, safety and protection!

Amazing new "SCOTCH-TRED"—the *resilient* non-slip surfacing material—is carpet quiet . . . tile tough! Pleasant textured surface is durable, long-wearing; brings new comfort and beauty to safety-conditioning. Easily cleaned with soap or water.

Soft . . . pliable . . . easily applied! "SCOTCH-TRED" comes in 9" squares and in 96-foot rolls in any width up to 36". It is easily cut with shears or knife. Strong pressure-sensitive adhesive sticks at a touch.

FOR EXTRA HEAVY-DUTY NEEDS, "SAFETY-WALK" is often used —a mineral-coated fabric that is practically indestructible.

Complete information and prompt service available from local wholesalers. Consult your nearest 3M branch office—today.

scotch•tred
BRAND
Resilient NON-SLIP SURFACING

"SCOTCH-TRED" and "SAFETY-WALK" are made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn. Export: 99 Park Ave., New York 16. Canada: London, Ontario.

MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW
3M COMPANY

CLIP and MAIL for FREE SAMPLE

3M COMPANY, Dept. AAF-99
St. Paul 6, Minn.

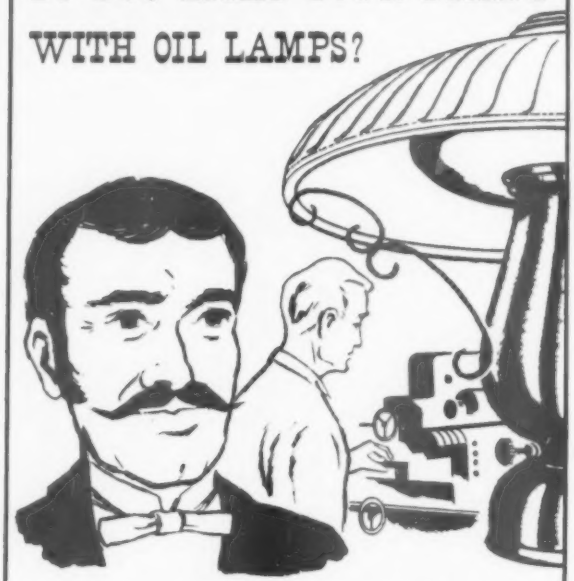
☐ Rush free sample of "SCOTCH TRED".
☐ Send sample and information on "SAFETY-WALK".

Name_____
Firm_____
Address_____
City_____ Zone____ State_____

For more facts Circle 663 on Reader Service Card

NEW!

DO YOU LIGHT YOUR PLANT WITH OIL LAMPS?



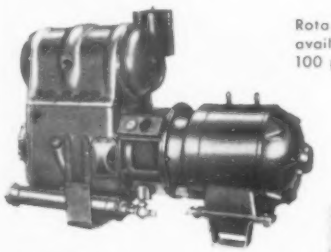
Today's new Davey Hydrovane Rotary Compressors are as far ahead of ordinary compressors as are electric lights by comparison with oil lamps.

Daveys have 50% fewer working parts than most other units. They're quiet, vibrationless, lightweight, compact . . . easier to install, more economical to operate. They are completely enclosed, no exposed belts or couplings.

NEW! They can be located anywhere, do not require a compressor room or special foundation. Only a small discharge outlet is needed. 180° discharge air lower than reciprocating compressors. Option of air-cooled or water-cooled oil coolers.

For facts about today's only *really modern* compressors, see your Davey distributor. Or, write for further information.

AA-9063



Rotary stationary units are available in 20 to 125 h.p. @ 100 p.s.i.

HYDROVANE DAVEY

Tank-mounted rotary compressors are offered in 2 to 5 h.p. @ 100-200 p.s.i.

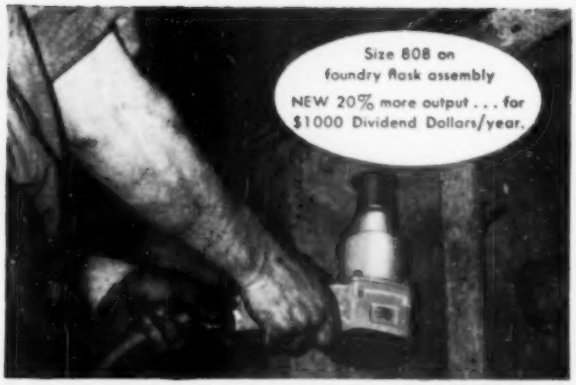
Distributors in all principal cities.

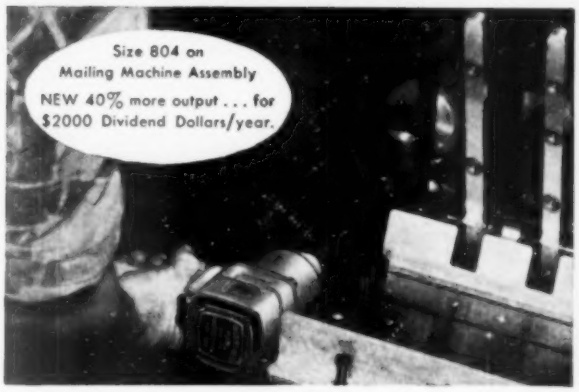
INDUSTRIAL DIVISION

DAVEY — pioneers of air-cooled air.

DAVEY COMPRESSOR CO.
Kent, Ohio

For more facts Circle 664 on Reader Service Card





4 NEW IR IMPACTOOLS

NEW designs NEW speeds NEW power to give you an

ANNUAL DIVIDEND on your PAYROLL DOLLARS

If your operators are using older model Impactools, you can increase their man-hour productivity by as much as $2000 Payroll Dollars in one year, just by replacing the older tools with one of the 4 new I-R designs.

Multiply these *Annual Dividends* by the number of Impactool operators in your plant, and you can see why management today is taking a new look at portable tool operations.

There's a fast, easy way to calculate the amount of *Dividend on Payroll Dollars* these new I-R Impactools can help you earn in just one year—without adding to your present payroll.

It's yours without obligation. To get it, call your I-R AIRengineer today. Or write Ingersoll-Rand, 11 Broadway, New York 4, N. Y. 8-920

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

Tools plus AIRengineering increase output per man

First from PHILCO®...

New All-Transistor
TV Camera for Industry

only $1445

Here's the camera that puts top quality industrial TV within reach of every company for round-the-clock surveillance of critical areas.

Your Philco Industrial TV system may include separate cameras, each connected to its monitor. It may be a combination of several cameras and monitors with centralized control, specifically designed to meet your requirements.

This new Philco all-transistor camera is lightweight, maintenance-free and foolproof. It combines excellent picture quality and complete reliability . . . at a saving of hundreds of dollars. Write for your copy of the new Philco TV Planning Book. *Government & Industrial Division, 4702 Wissahickon Avenue, Philadelphia 44, Pennsylvania. In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario.*

PHILCO QUALITY FIRST!

310 For more facts Circle 666 on Reader Service Card

when you buy
CLEANING MAINTENANCE SUPPLIES . . .

Look for this Emblem

PRODUCTS AND SERVICES FOR BETTER HEALTH
National MEMBER SANITARY SUPPLY ASSOCIATION ®

it's your assurance of Reliability and Integrity

Only members of the NATIONAL SANITARY SUPPLY ASSOCIATION display the above emblem. Strict membership requirements are your assurance that products and services offered will be of the highest quality and dependability. NSSA members have had long, successful experience in sanitary maintenance equipment and supplies—they can offer creative assistance in supplying your needs.

NATIONAL SANITARY SUPPLY ASSOCIATION
(Incorporated, Not-for-Profit)
National Headquarters, 159 N. Dearborn St., Chicago 1, Ill.

For more facts Circle 667 on Reader Service Card

HIGH TORQUE — SMALL SIZE

Stearns **MODEL "GS"** electro-magnetic disc

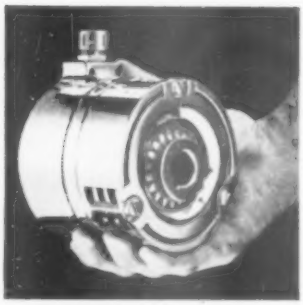
CLUTCH

Sets new standards of reliability and maintenance convenience.

TORQUE RANGE —
Dry—12 to 1260 lb ft
Wet (oil)—
16 to 1140 lb ft

SIZE RANGE —
Diameter—4½ to 9¼ inches
Length—3½ to 6 inches

WEIGHT—11 to 79 lb



New, High Torque, Stearns Model GS Clutches — Save on Space . . . Save on installation . . . Save on maintenance . . . Save on machine downtime . . . Save on faster, smoother, more efficient machine operation . . . Save on longer life — low-cost "wear" elements can be replaced "quick-as-a-wink" with just a screw driver as your complete tool kit.

Start Saving Right Now by calling your local Stearns representative. Or write, stating your specific requirements, directly to Stearns.

For Superior Performance . . . Specify Stearns!

Request Bulletin 226-M

Stearns ELECTRIC CORPORATION
120 NORTH BROADWAY
MILWAUKEE 2, WISCONSIN
Phone: BRoadway 1-2200

For more facts Circle 668 on Reader Service Card

First, here's what ABC Company found!
They could have the existing sash repainted...
BUT
They could have it bricked up—or boarded up...
BUT
There were several things they could do.
NO—the board 'em up, brick 'em up or repair ideas just didn't suit. There were too many "buts" about them.
THEY WERE LOOKING FOR:
ABC Company found that Glass Block Windows could save them $3031.00 in 1 year, on 10,000 square feet of window area! Here's how they figured.
How did the ABC Company turn 10,000 square feet of window problems into a SAVING of $3,031. YEAR?
From being conservative, they arrived at these amazing saving figures
Heating $1,010.00
Painting 750.00
Washing 750.00
TOTAL SAVING $3,031.00
Investigation brought GLASS BLOCKS to the attention of the ABC Company's building group.
They decided to check.
They found out some very interesting things.
They found out that the PRISMS on the inside faces of the Glass Blocks result in:

Cut Window Maintenance Costs This Book Tells How... It's Free

PC GLASS BLOCK SASH REPLACEMENT has been the once-and-for-all solution to window maintenance problems for hundreds of companies. A new PC book details their composite experience. It shows how and why PC Glass Block panels end sash painting worries and broken panes . . . prevent dust and dirt infiltration . . . cut heating-cooling costs . . . transform harsh daylight into soft, comfortable illumination. Mail the coupon and get your free copy.

Pittsburgh Corning Corporation
Dept. N-99, One Gateway Center, Pittsburgh 22, Pa.
Send me your new booklet on PC Glass Blocks for Sash Replacement.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

PITTSBURGH PC CORNING

HUNDREDS OF HOWE

DIAL SCALES

EASIER READING...
ACCURATE...LONGER LIFE

DIAL SCALES make your weighing easier and faster... and Howe has hundreds of standard dial scales on which you can get quick delivery at favorable prices.

And these are the latest, most modern dial scales available. You'll find many unusual features as standard equipment, including Howe's exclusive Tape Drive Dial Mechanism.* Naturally, you can use Howe accessories for printed weight records, remote weight indications, and many other weight control operations.

You probably have an unusual weighing problem—or you may just be interested in finding out about the many new and better dial scale types now available. Either way, contact your local Howe representative or Howe Scale, Rutland, Vt.

*Your Howe representative can explain it in detail, but it's a new and patented design which gives even greater accuracy, longer scale life.

NEW! DIAL SCALE CATALOG. Just out! Illustrated; gives specifications on dozens of standard and special types for industry and agriculture. Send for your free copy now!

HOWE

THE HOWE SCALE CO. · RUTLAND, VERMONT
A SUBSIDIARY OF SAFETY INDUSTRIES, INC.

For more facts Circle 670 on Reader Service Card

ADAMS FACT FILE #2

PLANT AIR

Moisture Chief Cause of Trouble...

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

Some of the Other Problems Created By Wet Compressed Air...

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

You Can Lick Compressed Air Moisture Problem...

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

Air Filter for Final Protection at Point of Use...

As an added safeguard for expensive tools and equipment, an Adams Poro-Stone Air Filter should be installed just before the air is used. These filters remove all solid material picked up by the air stream. With an Adams Aftercooler, Cyclone Separator and Air Filters clean, dry, trouble-free air is supplied to your production tools. You get continuous service with minimum maintenance.

For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 215 East Park Drive, Buffalo 17, New York.

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LIGHT DUTY GRINDING: A SKIL Raised Hub Wheel Kit and safety guard are all you need to quickly convert the 7" or 9" Disc Sander into a versatile grinder. Also for heavy-duty work.

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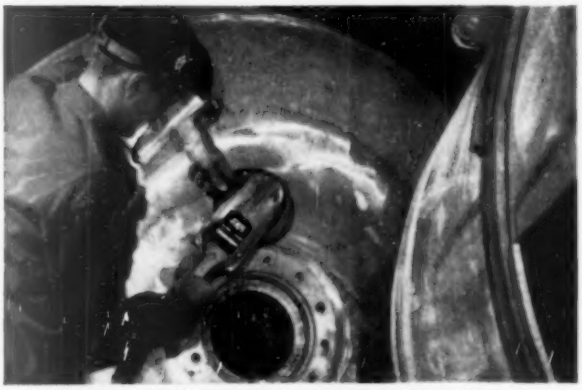

SANDING AND FINISH BLENDING: Smooth, steady, vibration free power lets you do faster, better sanding and finish blending in less time.

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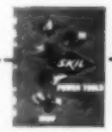

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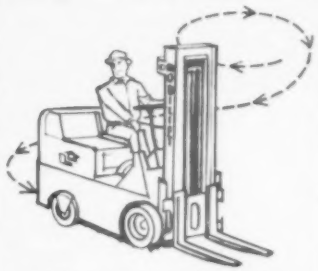

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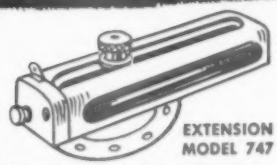

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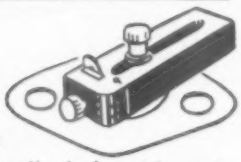

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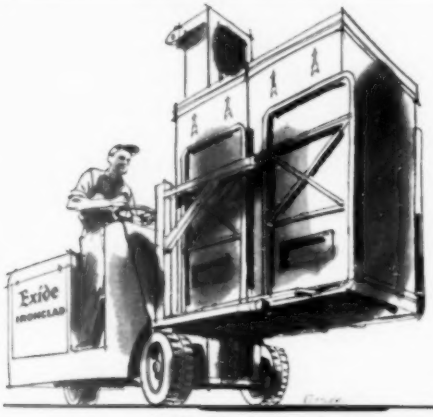
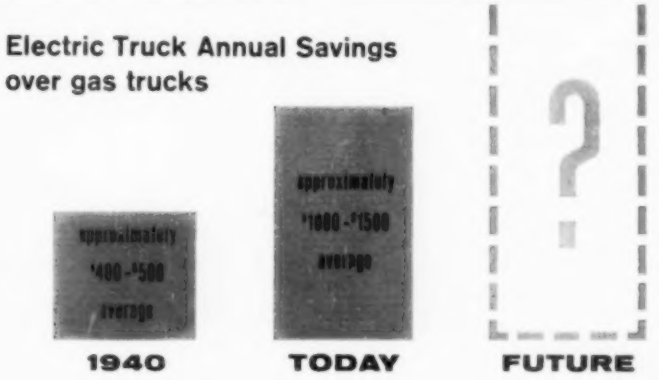
Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.





Why miss out on these economies? See how electric truck savings have grown since 1940. You could be saving money right now. And if this trend continues, you can save more every year in the future.

EASE THE PROFIT SQUEEZE

Electric Truck Economy Over Gas Keeps Growing and Growing

Even way back in 1940, Exide-battery-powered industrial trucks were roughly 30% more economical than gas-powered trucks. Today they're roughly twice as economical. And the trend suggests still greater economy in the future.

Inflation has driven the cost of most things up sharply. But in the field of materials handling, it has actually favored electric industrial trucks. Examine the three main ingredients of industrial truck cost: fuel, maintenance and depreciation.

The ingredients of truck cost

The cost of gasoline has gone up about 80% since 1940. But the cost of battery power is still at about the same level. This is partly because the cost of electricity itself has actually decreased. And new batteries and chargers give you more capacity and life per dollar of cost.

Maintenance labor rates and parts prices have gone up for both types of trucks. But electric trucks need less than half the maintenance that gas trucks do. Depreciation has always been lower for electric trucks and still is. This is the result of longer useful truck life—estimated to be from 2 to 3 times as great as that of gas trucks.

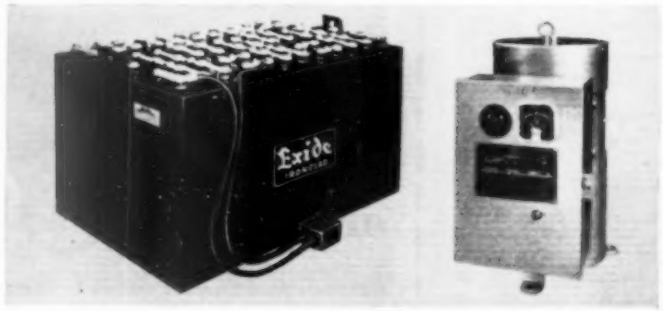
New batteries mean improved performance

Today's electric industrial trucks not only offer greater relative economy than ever before, but also the highest performance ever. The combination of advantages makes them today's best materials handling bargain. Two years ago Exide introduced new improved truck batteries that pack more power into the same space and offer longer life of service. This means that every truck can carry more power capacity for longer work shifts, longer runs, and higher productivity.

Typical savings

Records of thousands of trucks in a wide variety of typical applications indicate that average economies for electric trucks total up to $1500 per truck per year as compared with gas-powered trucks. Why don't you help your company "ease the profit squeeze" by putting electric trucks to work saving you money right now. Exide's plan for leasing batteries and chargers makes it possible to switch with a nominal capital investment.

For data that will assist you in analyzing your own operating costs, write for free copy of 14-page Form 6262



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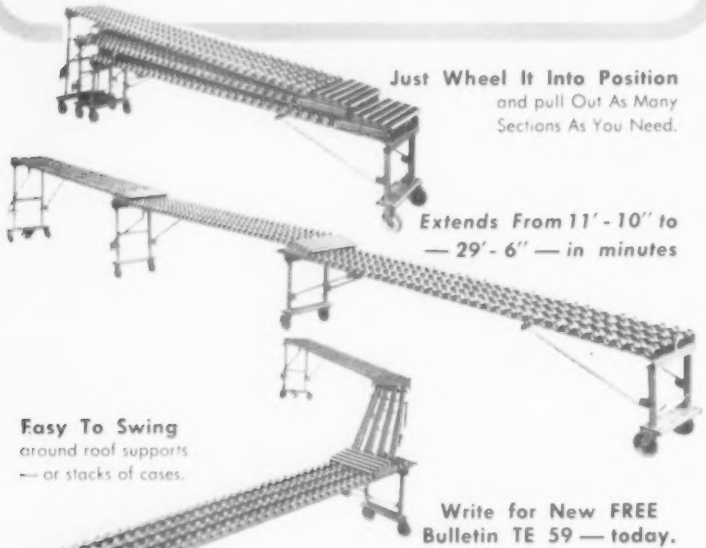

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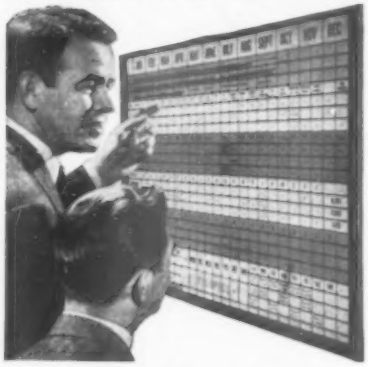

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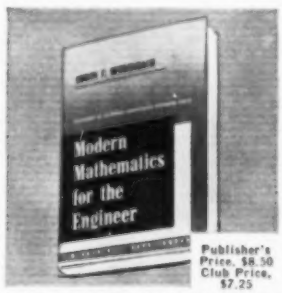

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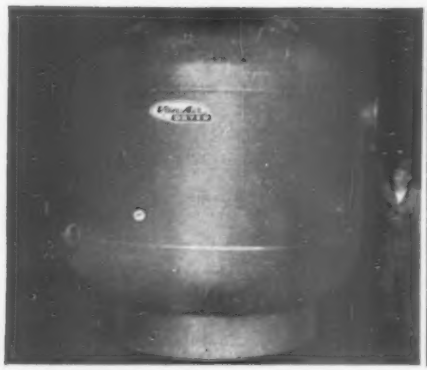

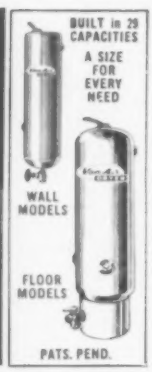

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ALSO AVAILABLE IN G-E RANDOM-WOUND MOTORS, the Polyseal system is used for stator and end turns, sealing windings with a waterproof, inert covering.

FOR MORE INFORMATION on Polyseal Insulation Systems, call your nearby G-E Apparatus Sales Office, or write for bulletin GEA-6889, Section 884-4, General Electric Co., Schenectady, N. Y.

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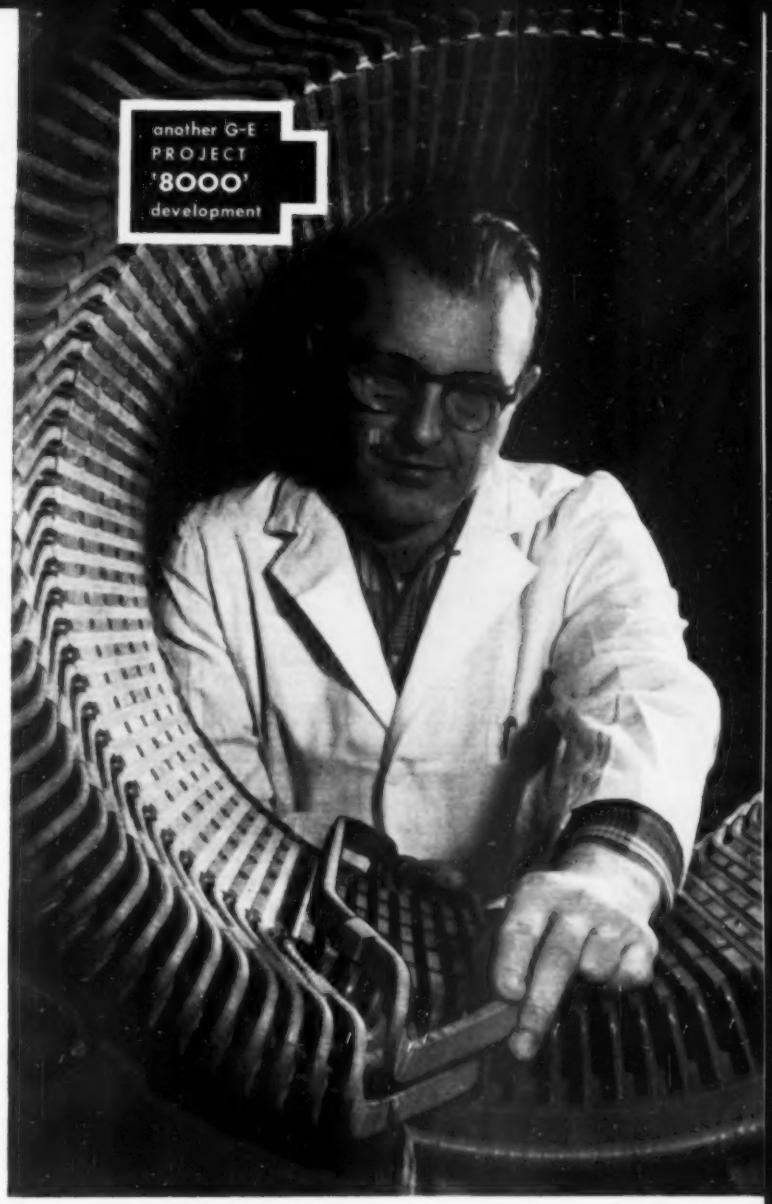

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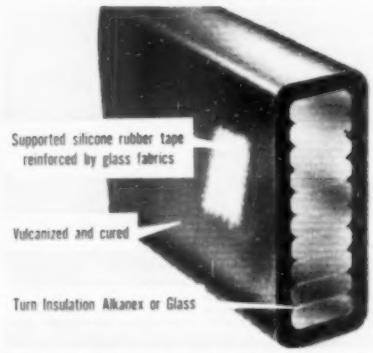

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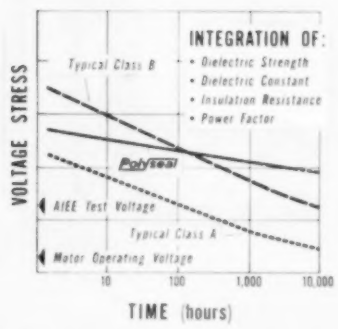

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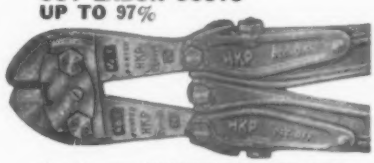

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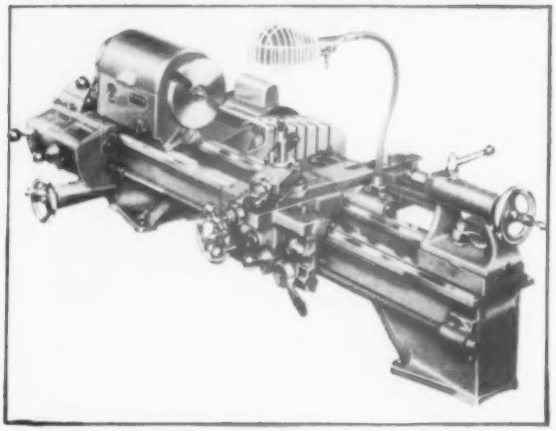

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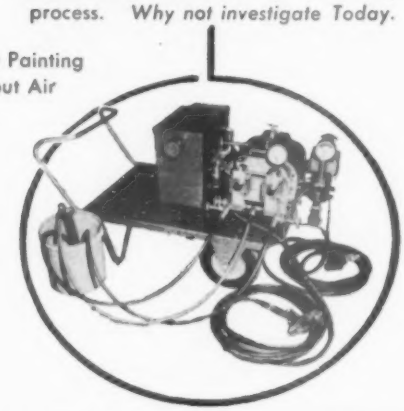

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SEE PAGE 331

THIS ISSUE

SEALMASTER

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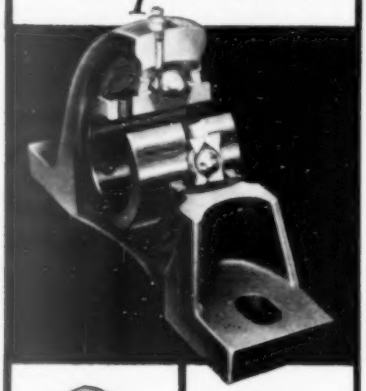

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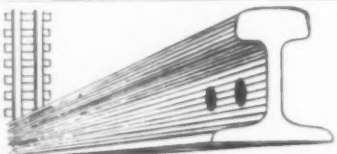

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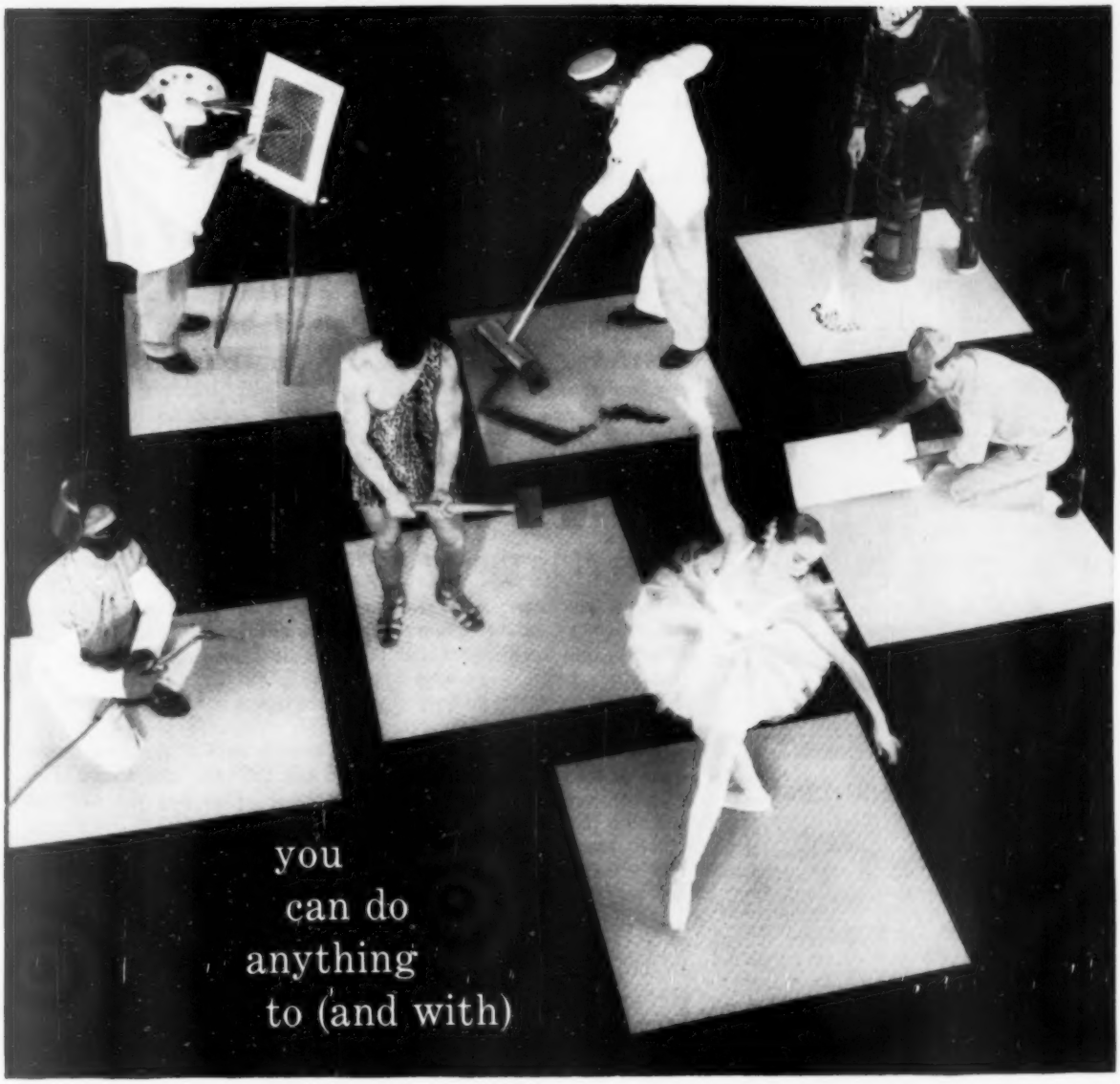

INLAND 4-WAY* SAFETY PLATE

As you can see, 4-WAY SAFETY PLATE is fireproof, can be bent, welded, hammered, painted. It can be cleaned with ease, can be cut, sheared, shaped to any curve or angle, drilled or punched. An outstanding feature of 4-WAY is its *slip-proof* character, as shown by the dancer. On catwalks, stair treads, truck beds, shop floors it provides positive traction, reduces hazards, safeguards employees.

Maintenance is extremely easy, fabrication and installation is simple. In many cases, no special skills are required—standard shop tools are all you need. On the floor, on the wall, on your machinery or your rolling stock, 4-WAY SAFETY PLATE is durable, attractive and economical. 4-WAY SAFETY PLATE is available from your Steel Service Center in Large Pattern—gages $\frac{3}{16}$" to $\frac{3}{4}$", Medium Pattern—gages 16 to $\frac{1}{4}$" and Small Pattern in 18 gage.

INLAND STEEL COMPANY

30 West Monroe Street • Chicago 3, Illinois

*Registered Trademark

For more facts Circle 697 on Reader Service Card

Reader sees ad...

refers to Local Sources...

calls local supplier...

gets help fast.

FACTORY ...PUBLISHER'S LETTER

Local Sources (opposite page) . . .

A Brand-New Reader Service

A publisher always gets a big kick out of seeing a new idea get off to a flying start. And he's doubly happy when he can see that the idea will have direct problem-solving value for his audience—the people who read his magazine.

I'm glad to say that I'm in this "doubly happy" frame of mind about our new Local Sources section, which is appearing for the first time in this issue—right on the facing page, in fact. Its purpose is to give readers a way to get problem-solving help fast from the representatives and distributors of companies that advertise their products in FACTORY.

You have often told us how busy you are—how you've had to wait, sometimes for weeks, to get additional information about equipment or services that promised to solve an operating problem.

Or, if you didn't want to wait, we've heard you complain about having to get on the phone and telephone, sometimes across the country, only to discover that there's a distributor or representative just around the corner who could have given you the whole story. What we're trying to do here in Local Sources is to help you overcome as many of these problems as we can.

Our method is to provide our advertisers with a directory in the form of local sources in which they can tell you just where their representatives and distributors are located. That way you can find the man just around the corner, and find him fast.

The pictures on the left will give you an idea of just how to use the new service. But because this is the first time we have brought you this service, we can't show you an actual case. So we've had to use a model and act out the sequence of events that we suspect will be typical of what will happen to many of you. (The handsome model, by the way, is Bill Thierer, FACTORY's business manager. He's the man who will be responsible for seeing that you get the benefits of Local Sources every month from now on.)

Here's how you use Local Sources, with Bill representing the typical FACTORY reader:

First, let's say you take a look at an advertisement that interests you. Run your eye down to the bottom of the page and you'll see a little slug of type that says "See Local Sources section." This is your tip-off that you can find a listing for this particular advertiser.

Second, you can now just turn back here to the Local Sources section and look up the advertiser by name.

Third, in most cases you will then be able to make your contact just by picking up the telephone.

Fourth, if you can't get all the information you need on the phone, you can have the benefit of a visit from a sales representative, sales engineer, distributor's representative, or other highly qualified person.

That's all there is to it. There's nothing complicated or difficult about it, and we sincerely hope that you will find it as useful as it is simple.

Donald B. Holute

FACTORY

ADVERTISERS' LOCAL SOURCES

DISTRIBUTORS • AGENTS • REPRESENTATIVES • BRANCH OFFICES

These listings are provided by advertisers in this issue of FACTORY to make it easy for you to get in touch with their local distributors, agents or representatives.

SEPTEMBER 1959

FACTORY ADVERTISERS'

LOCAL SOURCES

DISTRIBUTORS • AGENTS • REPRESENTATIVES • BRANCH OFFICES

SEPTEMBER, 1959

These listings are provided by advertisers in this issue of FACTORY to make it easy for you to get in touch with their local distributors, agents or representatives.

ACME-HAMILTON MFG. CORP.

(See Page 89)

MEADE STREET, TRENTON 3, N. J.
EXport 6-7631

CALIFORNIA

Los Angeles.....Acme-Pacific Corp. 5024 Hampton Street LUdlow 3-1835

GEORGIA

Atlanta.....649 Ponders Avenue, N.W. (P.O. Box 2661 Station D) JAckson 4-5861

ILLINOIS

Chicago.....1238 W. Washington Blvd. MOnroe 6-8145

NEW YORK

New York 19.....200 West 57th Street PLaza 7-5110

TEXAS

Houston 2.....2017 Preston Avenue (P.O. Box 2010) CApitol 3-4351

AMERICAN ENGINEERING COMPANY

(See Page 221)

PHILADELPHIA 37, PA.

ALABAMA

Birmingham.....Ray F. Frings ALpine 1-9361

CALIFORNIA

San Francisco.....Elder & Company UNderhill 1-5480

CONNECTICUT

Madison.....J. J. McArdle Co.
New Haven.....J. B. Engrg. Sales Co. LOcust 2-9311
West Haven.....Griesing Co., Inc. 349 Front Avenue

FLORIDA

Coral Gables.....G. F. A. MacKay MO 5-1965

GEORGIA

Atlanta.....Shepherd Equipt. Co. JAckson 2-6471

ILLINOIS

Chicago.....American Engineering Co. WAbash 2-6889
Mayer & Oswald, Inc. HArrison 7-0528
Rockford.....Roger R. Floody 6-1931

LOUISIANA

New Orleans.....Standard Equipt. Co., Inc. MA-4561

MARYLAND

Timonium.....S. M. Christhilf & Son, Inc. VAlley 5-5100

MASSACHUSETTS

Boston.....George E. Kent Co., Inc. COmmonwealth 6-5522

MICHIGAN

Detroit.....Hanson Equipment Co. TRinity 1-0697

MISSOURI

St. Louis.....Patton Equipt. Co., Inc. MIssion 7-0080

NEW JERSEY

Jersey City.....American Engineering Co. HEnderson 2-0555

NEW YORK

Albany.....L. E. Stewart & Son, Inc. 2-4095
Utica.....French Mill Supply Corp. 4-7103

NORTH CAROLINA

Charlotte.....Walter M. Anderson 4-6278

OHIO

Cincinnati.....L. J. Fliszik Co. KIrby 1-8299
Cleveland.....American Engineering Co. MAin 1-2497
Nook & O'Neill, Inc. HEnderson 2-3044
Columbus.....G. C. Asplind CApitol 4-4824
Toledo.....West Equipment Co. TAylor 1074

OREGON

Portland.....F. E. Bennett Company CA 8-2321

PENNSYLVANIA

Montoursville.....L. H. Lantz & Assoc. 8-8832
Philadelphia.....S. R. Vanderbeck & Sons STevenson 2-1350
Pittsburgh.....W. R. Bauer & Co. ATlantic 1-1489
York.....Charles E. Farscht 31-673

WASHINGTON

Seattle .....Charles Ind. Sales Co. LA-6010

WEST VIRGINIA

Huntington.....Marshall Equipt. Co., Inc. JA 3-8691

WISCONSIN

Wauwatosa.....John G. Steger & Assoc. BLuemound 8-6849

BEARINGS, INC.

(See Page 283)

3634 EUCLID AVENUE,
CLEVELAND 15, OHIO

DELAWARE

Wilmington 99....16th & Governor Printz Blvd. OLympia 6-2511

INDIANA

Fort Wayne.....432 Pearl St. ANthony 9425
Indianapolis 4.....801 N. Capitol Ave. MElrose 4-4393
Muncie.....301 N. Madison ATlas 4-1425
Terre Haute.....1476 Wabash Ave. CRawford 2035

MARYLAND

Baltimore 18.....1901 N. Howard St. VErnon 7-4700

NEW JERSEY

Camden 3.....1035 Wright Ave. WOodlawn 4-3965

OHIO

Akron 11.....20 Fair at Hackett St. JEfferson 5-4153
Canton 11.....913 Ninth St., S.W. GLendale 4-6194
Cincinnati 14.....1417 Central Parkway PArkway 1-8134
Cleveland 15.....3634 Euclid Ave. UTah 1-2828
Cleveland West 11.....3065 W. 117th St. CLearwater 2-6600
Columbus 15.....175 Cleveland Ave. CApital 1-7635
Dayton 2.....608 S. Jefferson St. BAldwin 2-3731
Elyria.....601 Cleveland St. EMerson 6-1841
Hamilton.....706 East Ave. TWinbrook 5-6911
Lima.....142 S. Elizabeth CAtherine 9-2060
Lockland (Cinci.).....105 Mill St. POplar 1-5200
Mansfield.....137 W. Sixth St. LAfayette 4-5171
Toledo 1.....1302 Washington St. CHerry 8-5311
Youngstown 2.....2007 South Ave. RIverside 4-5013
Zanesville.....738 Linden Ave. GLadstone 2-8437

PENNSYLVANIA

Erie.....812 Buffalo Rd. GLendale 4-6349
Johnstown.....107 Lincoln St. 9-1101
Philadelphia 40.....1607 W. Hunting Park Ave. DAvenport 9-9600
Pittsburgh 32.....5536 Baum Blvd. MUseum 1-4900
York.....1285 E. Princess St. 7857

WEST VIRGINIA

Charleston 32.....1516 Kanawha Blvd. West DIckens 60-641
Huntington 2.....2761 Fifth Ave. JAckson 3-6446
Parkersburg.....713 Gladstone St. GArfield 2-5478
Wheeling.....518 Main St. CEdar 3-4250

BALANROL CORPORATION

(Wholly Owned Subsidiary of Bearings, Inc.)

NEW YORK

Buffalo 1.....313 Niagara St. MOhawk 4425
Niagara Falls.....3105 Pine Ave. BUtler 4-0439

BOSTON GEAR WORKS

(See Page 181)

QUINCY 71, MASSACHUSETTS

Branch Offices

Atlanta, Georgia
484 - 14th St. N.W.....TRinity 6-7346
Chicago, Illinois
5445 W. North Ave.....NAtional 2-8740
Cleveland, Ohio
1702 St. Clair Ave. N.E.....MAin 1-5140
Dallas, Texas
7111 Empire Freeway.....RIverside 8-5801
Philadelphia, Penna.
4100 N. 16th Street.....DAvenport 9-7800
Oakland, Calif.
4770 San Pablo Ave.....OLympic 4-4687
Teterboro, New Jersey
400 Hollister Road.....ATlas 8-9555
Toronto 18, Ontario, Canada
275 Kipling Avenue So.....CLifford 9-9201

Distributors

ALABAMA

Birmingham.....Owen-Richards Co.
FA 2-3611
Mobile.....Bearings & Trans. Supply Co., Inc.
Hemlock 8-3591

ARIZONA

Phoenix.....Garrett Supply Co.
APplegate 8-5511

CALIFORNIA

Los Angeles.....Andrews Hardware & Metal
Madison 9-5030
Garrett Supply Co.
LUdlow 8-7221
San Jose.....C. W. Marwedel
CYpress 7-8207
San Francisco.....C. W. Marwedel
UNderhill 1-2125
San Leandro.....Republic Supply Co.
EI 7-2211

COLORADO

Denver.....Western Belting Co.
ALpine 5-1476

CONNECTICUT

Bridgeport.....Hawley Hardware Co.
FOrest 6-4541 & ENterprise 3900
Hartford.....Silliter-Holden, Inc.
ADams 2-4433
Waterbury.....White Supply Co.
ENterprise 4850

DELAWARE

Wilmington.....Lindsay-Oberholzer Corp.
OLympia 6-5461

FLORIDA

Jacksonville.....Morgans, Inc.
EL 5-1519
Miami.....Gondas Corp.
Plaza 7-5531
Tampa.....Tampa Armature Works, Inc.
2-1966

GEORGIA

Atlanta.....J. M. Tull Metal & Supply Co., Inc.
JAckson 5-3871

ILLINOIS

Chicago.....Chicago Pulley & Shafting Co.
FRanklin 2-7726
Samuel Harris & Co.
FR 2-7272
Power Transmission Equip. Co.
MOnroe 6-1500
Melrose Park.....Power Transmission Equip. Co.
FI 5-3075 & AU 7-9093
Peoria.....Illinois Bearing Co.
4-3106
Rockford.....Samuel Harris & Co.
WOodland 2-0606

INDIANA

Evansville.....Bearings Service Co.
Harrison 5-9095
Fort Wayne.....Fort Wayne Pipe & Sup.
Anthony 3441
Indianapolis.....Vonnegut Hardware Co.
MElrose 2-2321
South Bend.....Bearings Service Co.
At 9-5591

IOWA

Davenport.....Industrial Engr. Equip. Co.
3-9721
Des Moines.....Electrical Engr. & Equip. Co.
ATlantic 2-0431

KENTUCKY

Louisville.....Louisville Mill Supply
JUniper 3-3875

LOUISIANA

New Orleans.....McLellan Equipment Co.
TUlane 3415
Oliver H. VanHorn Co.
JAckson 2-8631
Shreveport.....Weaks Supply Co., Ltd.
3-8436

MARYLAND

Baltimore.....Carey Mchy & Sup. Co. Inc.
BRoadway 6-1600

MASSACHUSETTS

Boston.....Chandler & Farquhar Co.
LOngwood 6-7800
Springfield.....Standard Industrial Sup. Co., Inc.
REpublic 9-7311
Worcester.....W. M. Steel Co. Inc.
PLeasant 7-3821

MICHIGAN

Detroit.....The Boyer-Campbell Co.
Trinity 5-8500
Chas. A. Strelinger Co.
JE 9-6000
Grand Rapids.....Mackay Industrial Sales Co.
CHerry 1-1671
Saginaw.....Flack-Pennell Co.
PI 2-5181

MINNESOTA

Minneapolis.....Industrial Supply Co., Inc.
FEderal 9-8111
W. S. Nott Co.
FEderal 3-6501

MISSOURI

Kansas City.....Bossert Company
BA 1-9033
Elfeldt Mchy & Sup. Co.
Victor 2-5494
St. Louis.....Calcord-Wright Mchy & Sup.
Mission 7-4400
Sligo, Inc.
CE 1-3050

NEBRASKA

Omaha.....T. S. McShane Co. Inc.
Jackson 1273

NEW JERSEY

Camden.....Shingle & Gibb Co.
Walnut 2-5050 & Woodlawn 6-3687
Newark.....Squier, Schilling & Skiff
MArket 4-1200
Paterson.....Bernstein Bros. Inc.
MUlberry 4-6711
Trenton.....Lindsay-Oberholzer Corp.
OWen 5-5467
Woodbridge.....Hansen & Yorke Co. of N. J.
MErcury 4-4000

NEW YORK

Albany.....Sager-Spuck Supply Co. Inc.
3-4461
Brooklyn.....H. L. Dickie
STerling 8-2993-4-5
A. N. Nelson Inc.
MAin 5-3860
Buffalo.....Beals, McCarthy & Rogers, Inc.
WA 4900
Root, Neal & Co.
FAirview 6400
Elmira.....Syracuse Bearing South. Tier
REgent 3-9647
Long Island City.....L. C. Biglow & Co., Inc.
RA 9-8282
New York City.....L. C. Biglow & Co., Inc.
COlumbus 5-4160
Hansen & Yorke Co., Inc.
BEekman 3-6000
Frank Tracy, Inc.
CAnal 6-3500
Richmond Hill.....Dale Gear & Bearing Sup.
VIrginia 6-4200
Rochester.....John M. Forster Co.
Schenectady.....Syracuse Supply Co.
ELgin 5-2000
Syracuse.....Syracuse Supply Co.
HOward 3-9511
Utica.....Syracuse Bearing Utica Corp.
SWift 7-1590

NORTH CAROLINA

Charlotte.....Mize Company, Inc.
Ed 3-0356
Greensboro.....Odell Mill Supply Co.
BRoadway 2-2113
Kinston.....Carolina Mchy & Sup. Co.
JAckson 7-1164
Rocky Mount.....Carolina Mchy & Sup. Co.
Gibson 6-8161-2
Winston-Salem.....Kester Machinery Co.
PArk 2-6181

OHIO

Akron.....Mau-Sherwood Supply Co.
BL 3-4161
Cincinnati.....Queen City Supply Co.
Poplar 1-4210
The Scallan Supply Co.
PLaza 1-1010
Cleveland.....Mau-Sherwood Supply Co.
TO 1-4500
Strong, Carlisle & Hammond
TOwer 1-8800
Columbus.....Ohio Transmission Co.
Hickory 4-2178
Dayton.....Transmission, Inc.
Baldwin 2-1244
Toledo.....Ohio Belting & Trans.
JEfferson 1-1481
Youngstown.....Somers, Fitler & Todd
SWeetbriar 9-1556

OKLAHOMA

Oklahoma City.....Marshall Sup. & Equip.
Central 2-8836
Tulsa.....Marshall Sup. & Equip.
Luther 4-5275

OREGON

Portland.....J. E. Haseltine & Co.
CApitol 8-7511

PENNSYLVANIA

Allentown.....Wm. H. Taylor & Co.
HE 4-7241
Bala-Cynwyd.....Maddock & Co., Inc.
TRinity 8-4700
Erie.....H. P. Weller Supply Co.
2-1401
Lancaster.....Herr & Co., Inc.
EXpress 7-2841
Philadelphia.....Lindsay-Oberholzer Corp.
GLadstone 7-3500
Pittsburgh.....Frick & Lindsay Co.
FAirfax 1-5700
Somers, Fitler & Todd Co.
COurt 1-4860
Wilkes-Barre.....Holmes Metallic Co.
VA 2-7196
York.....York Machinery & Sup. Co.
29-531

RHODE ISLAND

Providence.....Machine Parts Corp.
PLantations 1-4334

SOUTH CAROLINA

Greenville.....Greenville Textile Sup. Co.
CEdar 3-6241

TENNESSEE

Chattanooga.....Mills & Lupton Sup. Co.
AMherst 6-6171
Knoxville.....Hoyt N. Payne Co.
3-5185
Memphis.....E. C. Blackstone Co.
Jackson 5-0382
Nashville.....Tennessee Mchy. Co.
ALpine 4-3417

TEXAS

Dallas.....Engineering Supply Co.
FL 7-6121

(Turn the page)

(Boston Gear Works—cont'd)

Geo. J. Fix Co.
Riverside 8-2218

Houston.....Geo. J. Fix Co.
CApitol 5-6648
Plowden Supply Co.
WAlnut 8-3311

San Antonio.....Midcap Bearing Service
CA 7-1301

UTAH

Salt Lake City.....Industrial Sup. Co., Inc.
EM 3-6727

VIRGINIA

Norfolk.....Industrial Bearings Co. of Virginia, Inc.
MAdison 5-0506

Richmond.....Industrial Supply Corp.
EL 5-8041

Waynesboro.....Mize Supply Company
WHitehall 2-8273

WASHINGTON

Seattle.....Cragin & Company
MA 3-0052

Spokane.....J. E. Haseltine & Co.
FA 7-4448
Campbell Indus. Supply Co.
MAin 2-5567

Tacoma.....Campbell Indus. Supply Co.
FUlton 3-2431

WEST VIRGINIA

Charleston.....Baldwin Supply Co.
DIckens 6-9661

WISCONSIN

Appleton.....Wisconsin Bearing Co.
REgent 3-7346

Green Bay.....A-C Supply Co.
HEmlock 7-6545

Milwaukee.....A-C Supply Co.
DIvision 2-1161
Wisconsin Bearing Co.
ORchard 2-9220

CANADA

Hamilton, Ontario..Renold Chains Canada, Ltd.
130 Ferguson Ave., N.

London, Ontario....Renold Chains Canada, Ltd.
1024 Oxford St., E.

Montreal, Quebec..Renold Chains Canada, Ltd.
1006 Mountain St.
Williams & Wilson, Ltd.
544 Inspector St.

Quebec City, Quebec....Renold Chains Canada, Ltd. 755 Blvd. Des Capucins

Three Rivers, Quebec..Renold Chains Canada, Ltd. 375 St. Georges St.

Toronto, Ontario....Renold Chains Canada, Ltd.
33 Edward St.
Williams & Wilson, Ltd.
71 Front St. E.

Vancouver, B.C. ....Renold Chains Canada, Ltd.
1066 Seymour St.
A. R. Williams Mchy Western, Ltd.
MUtual 4-9411

Winnipeg, Manitoba....Renold Chains Canada, Ltd. 1302 Notre Dame Ave.

A FACTORY Problem-Solver

New Fire Fighter

A new long-name chemical compound makes short work of liquid fuel and electrical fires, according to Army engineers. The new multi-syllable name: Monobromotrifluoromethane.

It's for use in conventional hand-operated fire extinguishers. It's said to extinguish some types of fires twice as fast as conventional equipment. Especially effective at sub-zero temperatures.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION THE CLEVELAND CRANE & ENGINEERING CO.

(Page 82)

EAST 289 ST. WICKLIFFE, OHIO

ALABAMA

Birmingham 4.....Cleveland Tramrail
Birmingham Co., 113 N. 9th St.
ALpine 2-5104

CALIFORNIA

Los Angeles 22.....Cleveland Tramrail
California Co., 6435 Corvette St.
RAymond 3-5205

San Francisco 2.....Cleveland Tramrail
California Co., 870 Market St.
EXbrook 7-0737

COLORADO

Denver.....Cleveland Tramrail Denver Co.
1700 Fifteenth St.
MAin 3-3221

CONNECTICUT

North Haven.....Cleveland Tramrail Division
Devine St.
CHestnut 8-5561

FLORIDA

Pompano Beach.....Cleveland Tramrail
Florida Co., P.O. Box 2812
WE 3-4941

GEORGIA

Atlanta 5 .....Cleveland Tramrail Atlanta Co.
2793 Piedmont Rd., N. E.
CEdar 3-7349

Atlanta 5.....Cleveland Tramrail Knoxville Co.
2793 Piedmont Rd., N. E.
CEdar 7-4357

ILLINOIS

Chicago 6.....Cleveland Tramrail Chicago Co.
565 W. Washington Blvd.
FRanklin 2-5573

Moline.....Cleveland Tramrail Sheldon Co.
5422 - 1st Avenue
4-1343

Peoria 1.....Cleveland Tramrail Peoria Co.
P.O. Box 222
5-5219

INDIANA

Fort Wayne.....Cleveland Tramrail
Fort Wayne Co., 3217 U.S. 30 East
EAstbrook 4662

Indianapolis 5.....Cleveland Tramrail
Indianapolis Co., 1121 East 46th St.
CLifford 5-5468

KENTUCKY

Louisville 2....Cleveland Tramrail Louisville Co.
104 W. Main St.
JUniper 3-1341

LOUISIANA

New Orleans 3.....Cleveland Tramrail
New Orleans Co., P.O. Box 238
TUlane 3415

MARYLAND

Baltimore 5....Cleveland Tramrail Baltimore Co.
819 No. Castle St.
EAstern 7-6789

MASSACHUSETTS

Cambridge 41.....Cleveland Tramrail Division
117 First St.
UNiversity 4-9880

MICHIGAN

Comstock.....Cleveland Tramrail Grace Co.
P.O. Box 67
FIreside 4-4775

Detroit 34.....Cleveland Tramrail Division
P.O. Box 4674
JEfferson 9-6000

MINNESOTA

Minneapolis 6.....Cleveland Tramrail
Twin City Co., 2907 E. Franklin Ave.
FEderal 9-2719

MISSOURI

Kansas City 14.....Robert H. Douglas
8162 Bellevue St.
DElmar 3-4291

St. Louis 17....Cleveland Tramrail St. Louis Co.
2683 Big Bend Blvd.
STerling 1-7000

NEW JERSEY

Kenilworth.....Cleveland Tramrail Division
Sidney Rd.
COrtland 7-5651

Trenton 8.....Cleveland Tramrail
Wiley-Hughes Co., 801 New York Ave.
EXport 3-4273

Union.....Cleveland Tramrail Newark Co.
P.O. Box 351
MUrdock 8-1827

NEW YORK

Buffalo 26.....Cleveland Tramrail Buffalo Co.
Box 2691 Amherst Station
UNiversity 7969

New York City.....(See Kenilworth, N. J.)

Scotia 2.....Cleveland Tramrail Albany Co.
105 Glen Ave.
FRanklin 2-8531

Syracuse 2....Cleveland Tramrail Syracuse Co.
433 So. Salina St.
HA 2-3207

NORTH CAROLINA

Charlotte 1.....Cleveland Tramrail
Carolinas Co., 123-125 W. 29th St.
ED 2-5026

OHIO

Akron 10.....Cleveland Tramrail Akron Co.
619 E. Tallmadge Ave.
FRanklin 6-4174

Cincinnati 9.....Cleveland Tramrail
Cincinnati Co., 3799 Madison Avenue
TRinity 1-3737

Cleveland 8.....Cleveland Tramrail Webb Div.
488 E. 105th St.
ULster 1-2161

Columbus 14.....Cleveland Tramrail Division
629 Garrett Drive
AXminster 4-3739

Toledo 12.....Cleveland Tramrail Toledo Co.
534 Laskey Rd.
GReenwood 9-2223

PENNSYLVANIA

Erie.....Cleveland Tramrail Division
2401 West 12th St.
GLendale 6-4285

Philadelphia 43.....Cleveland Tramrail Division
945 So. 53rd St.
GRanite 6-2452

Pittsburgh 22.....Cleveland Tramrail
Pittsburgh Co., 1112 House Bldg.
GRant 1-2022

Scranton 5.....John J. Weis & Son
P.O. Box 1286
DIamond 7-4825

RHODE ISLAND

Providence 3.....Cleveland Tramrail
Rhode Island Co., 156 West Exchange St.
GA 1-7333

TENNESSEE

Knoxville.....(See Atlanta, Ga.)

Memphis 4....Cleveland Tramrail Memphis Co.
32 North Cleveland St.
BR 5-3629

TEXAS

Dallas 6.....Cleveland Tramrail Texas Co.
5542 Dyer St.
EMerson 1-2859

Houston 25.....Cleveland Tramrail Texas Co.
4007 Bellaire
MAdison 3-8422

UTAH

Salt Lake City 17.....R. B. Rees & Co.
2906 Delsa Drive
CRestwood 7-3529

VIRGINIA
Richmond 20.....Cleveland Tramrail
Richmond Co., 531 Brook Rd.
Milton 8-7019

WASHINGTON
Seattle 8....Cleveland Tramrail Northwest Co.
300 Michigan St.
PA 2-0631

WEST VIRGINIA
Huntington 1.....Cleveland Tramrail
Huntington Co., 713 Fifth Ave.
JAckson 2-6105

WISCONSIN
Milwaukee 13.....Cleveland Tramrail
BLuemound 8-9860
Milwaukee Co., 7011 W. North Ave.

A FACTORY Problem-Solver

Raw Material Data

Allis-Chalmers Manufacturing Company's new pilot plant just went on stream at Carrollville, Wis. It will provide many anxiously awaited answers on agglomeration, heat treating, and processing of a wide variety of raw materials.

Among the materials scheduled for intensive study are magnetite and hematite concentrates, natural fine iron ores, silicious bauxite, magnesite, cement, phosphate, dolomite, and limestone. To assure completeness and accuracy, the pilot plant operation will be a model of efficiency and versatility.

DIXIE BEARINGS, INC.
(See Page 283)
276 MEMORIAL DR. SW,
ATLANTA, GEORGIA

FLORIDA
Jacksonville.....1826 Ionia St.
ELgin 6-2618

GEORGIA
Atlanta.....276 Memorial Dr. SW
JAckson 4-5601

KENTUCKY
Louisville.....215 S. Floyd St.
JUniper 3-2775

LOUSIANA
Baton Rouge.....2905 Weller Ave.
ELgin 7-2257
New Orleans 12.....401 Howard Ave.
MAgnolia 6363

NORTH CAROLINA
Charlotte.....1621 N. Tryon St.
EDison 2-2151
Greensboro.....231 E. Washington St.
BRoadway 4-4686

SOUTH CAROLINA
Greenville.....407 Pendleton St.
CEdar 5-9601

TENNESSEE
Chattanooga 8.....2423 S. Broad St.
AMherst 7-9526
Kingsport.....130 Clay St.
CIrcle 6-6195
Knoxville 16.....417 Dale Ave.
5-4137
Nashville.....511 Eighth Ave. South
CHapel 2-7351

VIRGINIA
Richmond.....1503 Chamberlayne Ave.
Milton 4-7837

THE FAIRBANKS COMPANY
(See Page 138)
393 LAFAYETTE STR., NEW YORK 3, N. Y.

Branch Offices

GEORGIA
Rome.....202 Division Str.
ROme 9786

ILLINOIS
Chicago, 8.....2600 So. Throop Str.
CAlumet 5-3600

MASSACHUSETTS
Boston, 10.....520 Atlantic Ave.
LIberty 2-2000

NEW YORK
New York, 3.....393 Lafayette Str.
SPring 7-8800

PENNSYLVANIA
Pittsburgh, 22.....15 Stanwix Str.
COurt 1-1887

GOULD-NATIONAL BATTERIES, INC.
(See Page 86)
TRENTON 7, N. J.

ALABAMA
Birmingham.....1304 N. 34th St.

ARIZONA
Phoenix.....1007 Grand Ave.

CALIFORNIA
La Puente.....14,500 Nelson Ave.
Oakland.....949 55th St.

COLORADO
Denver.....4150 Fox St.

CONNECTICUT
Bridgeport.....2131 Main St.

DISTRICT OF COLUMBIA
Washington.....824 Transportation Bldg.

FLORIDA
Jacksonville .....5422 Waterside Drive

GEORGIA
Atlanta.....Farrar Bldg.
10 N. Claredon Rd.

ILLINOIS
Chicago.....100 E. Ohio St.
Kankakee.....W. Station Rd.
Rock Island.....602 1st Street

INDIANA
Indianapolis.....1635 North Gent Ave.

LOUISIANA
New Orleans.....1208 N. Broad St.

MARYLAND
Baltimore.....202 E. 25th St.

MASSACHUSETTS
Boston.....43 Leon St.

MICHIGAN
Detroit.....3105 E. Grand Blvd.

MINNESOTA
St. Paul.....1728 Roblyn Ave.

MISSOURI
Kansas City.....7941 State Line Rd.
St. Louis.....2311 Hampton Ave.

NEW JERSEY
Jersey City.....805 Garfield Ave.
Trenton.....Phone: EXport 2-3111

NEW YORK
Buffalo.....1413 Hertel Ave.
Depew.....35 Neoga St.
New York .....7 Dey St.
E. Syracuse.....2201 Teall Ave.

NORTH CAROLINA
Charlotte.....5400 Seacroft Rd.

OHIO
Cincinnati.....817-819 Keith Bldg.
525 Walnut St.
Cleveland.....Avenue Bldg.
4500 Euclid Ave.
Columbus.....81 E. State St.
Toledo.....Box 503

OREGON
Portland.....1973 N.W. Lovejoy St.

PENNSYLVANIA
Philadelphia.....1014 Beury Bldg.
Pittsburgh.....1597 Banksville Rd.
Reading.....320 Berks Cnty. Trust Bldg.
35 N. 6th St.

TENNESSEE
Chattanooga.....902 Chattanooga Bank Bldg.
Memphis.....2215 Persons Ave.

TEXAS
Dallas.....137 Walnut Hills Village
Houston.....6603 Kirbyville St.

UTAH
Salt Lake City.....415 South 2nd East

W. VIRGINIA
Huntington.....1111 Vernon St.,
P.O. Box 2105

VIRGINIA
Richmond.....302 E. Main St.

WISCONSIN
Milwaukee.....1118 N. Jefferson St.

I-T-E CIRCUIT BREAKER COMPANY
(See Page 22, 23)
1900 HAMILTON ST., PHILADELPHIA 30, PA.

ALABAMA
Birmingham 9.....Jos. W. Eshelman & Co., Inc.
1812 28th Ave., So., Homewood
P. O. Drawer 5906
TRemont 9-3462

ARIZONA
Tucson.....Central Station Equipment Co.
2323 Aviation Highway
MAin 3-2493

CALIFORNIA
Los Angeles 21.....I-T-E Circuit Breaker Co.
1921 E. 7th St.
MAdison 2-7134
San Francisco 5.....I-T-E Circuit Breaker Co.
230 Ryanway
YUkon 2-2760 & YUkon 2-3397

COLORADO
Denver 3.....I-T-E Circuit Breaker Co.
Rm. 410, 655 Broadway Bldg.
AMherst 6-1404

CONNECTICUT
Hamden 18.....I-T-E Circuit Breaker Co.
2315 Whitney Ave.
P. O. Box 5335
ATwater 8-9273

DISTRICT OF COLUMBIA
Washington 5.....I-T-E Circuit Breaker Co.
1012 14th St., N.W.
DIstrict 7-2326

FLORIDA
Eustis.....R. P. Smith & Co.
P. O. Box 1537
ELgin 7-2120
Jacksonville 7.....Robert P. Smith & Co.
P. O. Box 5877
1446 June St.
EXbrook 8-0531
South Miami 43.....I-T-E Circuit Breaker Co.
4216 Ponce de Leon Blvd.
P. O. Box 797
Highland 4-8217
Tampa 9.....Robert P. Smith & Co.
1521 South Dale Mabry Highway
P. O. Box 10205
8-3612

(Turn the page)

(I-T-E Circuit Breaker—cont'd)

GEORGIA

Atlanta 5.....I-T-E Circuit Breaker Co.
Rms. 203, 205, 3131 Maple Drive
CEdar 7-6361

ILLINOIS

Chicago 3.....I-T-E Circuit Breaker Co.
Rm. 1719, Bankers Bldg.
105 West Adams St.
STate 2-6132

INDIANA

Indianapolis 2.....I-T-E Circuit Breaker Co.
1224 N. Capitol Ave.
MElrose 9-3454

IOWA

Davenport.....I-T-E Circuit Breaker Co.
P. O. Box 241, 218 Brady St.
6-5327

LOUISIANA

New Orleans.....I-T-E Circuit Breaker Co.
1500 Carondelet St.
Shreveport.....Butler & Land, Inc.
1845 Line Ave.
2-0697

MARYLAND

Baltimore 12.....I-T-E Circuit Breaker Co.
7215 York Rd.
VAlley 5-3950

MASSACHUSETTS

Boston 16.....I-T-E Circuit Breaker Co.
31 St. James Ave.
HAncock 6-3630

MICHIGAN

Detroit 35.....I-T-E Circuit Breaker Co.
16907 W. 8 Mile Rd.
WOodward 5-1824

MINNESOTA

Minneapolis 4.....I-T-E Circuit Breaker Co.
Nicollet Exchange Bldg.
2025 Nicollet Ave.
FEderal 9-8796

MISSOURI

Kansas City 5.....I-T-E Circuit Breaker Co.
Rm. 920, Dwight Bldg.
VIctor 2-2101

St. Louis 5.....I-T-E Circuit Breaker Co.
7 N. Brentwood Blvd.
PArkview 7-6202

MONTANA

Butte.....R. E. McDonough Co.
829 Maryland Ave.
P. O. Box 278
2-5447

NEBRASKA

Omaha 32.....I-T-E Circuit Breaker Co.
Dodge Center Bldg.
Rm. 205, 5002 Dodge St.
CApital 0255

NEW YORK

New York 7.....I-T-E Circuit Breaker Co.
233 Broadway
BArclay 7-5670
(Newark) MArket 3-7678

Syracuse 2.....I-T-E Circuit Breaker Co.
Rms. 205, 207, O'Donnell Bldg.
321 Erie Blvd., West
HArrison 2-2338
2690 Sheridan Drive
AMherst 9880

NORTH CAROLINA

Charlotte 2.....I-T-E Circuit Breaker Co.
215 E. Morehead St.
EDison 4-0814

OHIO

Cincinnati 12.....I-T-E Circuit Breaker Co.
4557 Montgomery Rd.
REdwood 1-3966

Cleveland 20.....I-T-E Circuit Breaker Co.
11800 Shaker Blvd.
SKyline 2-4330

OKLAHOMA

Tulsa 20.....I-T-E Circuit Breaker Co.
816 East Sixth St.
LUther 4-2616
CHerry 2-0802

OREGON

Portland 9.....Garland Affolter Engrg Corp.
1233 N. W. 12th Ave.
CApitol 3-7349

PENNSYLVANIA

Kingston.....I-T-E Circuit Breaker Co.
P. O. Box 606
BUtler 7-1943

Philadelphia 4.....I-T-E Circuit Breaker Co.
Suite 201, 101 No. 33rd St.
EVergreen 6-0900

Pittsburgh 22.....I-T-E Circuit Breaker Co.
Rm 554—One Gateway Center
420 Fort Duquesne Blvd.
GRant 1-2970

TENNESSEE

Memphis.....I-T-E Circuit Breaker Co.
219 Adams Street

TEXAS

Amarillo.....Butler & Land, Inc.
1505 West 10th St.
DRake 6-5255

Dallas 5.....Butler & Land, Inc.
5538 Dyer St.
P. O. Box 8085
EMerson 1-6631

El Paso.....R. L. Brewer Co., Inc.
P. O. Box 1547
Rm 204, Blumenthal Bldg.
100 So. El Paso St.
KEystone 2-7651

Houston 2.....I-T-E Circuit Breaker Co.
2525 San Jacinto St.
CApitol 8-2378

UTAH

Salt Lake City 10.....Riter Engrg Co.
1369 Major St.
P. O. Box 2187
INgersoll 7-9449

WASHINGTON

Seattle 1.....Garland Affolter Engrg Corp.
2603 Western Ave.
MUtual 2-4950

WEST VIRGINIA

Charleston.....W. J. Hess & Son
3145 Washington St. West
P. O. Box 10066
RIverside 4-1821

WISCONSIN

Milwaukee 3.....I-T-E Circuit Breaker Co.
Rm 405, 210 W. Michigan St.
BRoadway 1-7900

A FACTORY Problem-Solver

Saves 165 Years

It would have taken one man and a sliderule until the year 2124 to solve the problems involved in designing Chrysler Corporation's 1960 line of cars. But using the electronic wizardry of the space age, Chrysler design engineers solved these problems so new cars will roll off the assembly line on schedule this fall.

To eliminate vibrations alone in new models, 500 key questions were fed to digital computers. Using the answers, Chrysler engineers developed new engine mountings that transmit a minimum of high- and low-frequency vibrations.

THE KENDALL COMPANY
POLYKEN SALES DIVISION

(See Page 245)
309 W. JACKSON BLVD., CHICAGO 6

ARKANSAS

Little Rock.....Arkansas Paper Co.
Pine Bluff.....Smith Paper Products Co

CALIFORNIA

Emeryville.....Zellerbach Paper Co.
Fresno.....Zellerbach Paper Co.
Hawthorne.....American Latex Products Corp.
Highland.....Richmond Paper Co.
Hollywood.....Reese Supply Co. Inc.
Los Angeles.....Fillmore & Garbar
Los Angeles.....L A Supply Co.
Los Angeles.....Kent H. Landsberg Co. Inc.
Los Angeles.....Noland Paper Co. Inc.
Los Angeles....Western Fibrous Glass Products
Los Angeles.....Wilson Paper Co.
Los Angeles.....Zellerbach Paper Co.
National City.....Zellerbach Paper Co.
Oakland.....Harry P. Robarts Co.
Sacramento.....Zellerbach Paper Co.
San Diego.....Buel-Town Co.
San Francisco.....Gilmore Steel & Supply Co.
San Francisco.....C. J. Hendry Co.
San Francisco.....Hobart Bros.
San Francisco..Western Fibrous Glass Products
San Francisco.....Zellerbach Paper Co.

COLORADO

Denver.....Emblem Tape & Label Co.
Denver.....Katzke Bros. Paper Co.
Denver.....Union Supply Co. Inc.

CONNECTICUT

Bridgeport.....Equity Paper Co.
Bridgeport.....Lott-Merlin, Inc.
Bridgeport.....Rourke-Eno Paper Co.
Hartford.....Rourke-Eno Paper Co.
New Britain.....Mill Supplies, Inc.
New Haven.....The Chatfield Paper Co.
Stamford.....Lott-Merlin, Inc.

FLORIDA

Jacksonville.....Industrial Marine Service
Jacksonville....Sperry Packaging & Distributing
Miami.....Gondas Corporation
Tampa.....Industrial Supply Corp.

GEORGIA

Atlanta.....Dillard Paper Co.
Atlanta.....Wyant & Sons Paper Co.
National Paper Div
Macon.....Dillard Paper Co.

ILLINOIS

Chicago.....Abana Products Inc.
Chicago.....Chicago Paper Co.
Chicago.....Chukerman Paper Co.
Chicago.....Durable Products
Chicago.....Inlander-Steindler Paper Co.
Chicago.....Knox & Schneider
Chicago.....Schwarz Paper Co
Peoria.....Schwarz Paper Co.

INDIANA

Ft. Wayne.....Allen Steel & Supply Co.
Hammond.....Inlander-Steindler Paper Co.
Indianapolis.....Donham-Harris Inc.
Indianapolis.....Duo-Fast of Indiana
Indianapolis.....Ochs Paper Co. Inc.
South Bend 24.....Valley Paper Co. Div. of
Schwarz Paper Co.

IOWA

Davenport.....Peterson Paper Co.
Sioux City.....Carpenter Paper Co.
Waterloo.....Waterloo Paper Co.

KANSAS

Wichita.....Southwest Paper Co.

KENTUCKY

Louisville.....Southeastern Paper Co.

LOUISIANA

New Orleans.....Stevens-Band Paper Co.
Shreveport.....Louisiana Paper Co., Ltd.

MARYLAND

Baltimore.....F. W. Winne & Son, Inc.
Hyattsville.....Seaboard Papers, Inc.

MASSACHUSETTS

Boston.....Andrews Paper Co.
Cambridge.....H. J. Dowd Co., Inc.
Springfield.....Carter Paper Co.
Springfield.....Rourke-Eno Paper Co., Inc.
Worcester.....The J. C. Campbell Paper Co. of Worcester

MICHIGAN

Battle Creek.....Cortright Paper Co.
Detroit.....F. W. Winne & Son Inc.
Grand Rapids.....Grand Rapids Paper Co.
Jackson.....Crown Paper & Bag Co.
Lansing.....Cathey Company
Muskegon.....Steindler Paper Co.

MINNESOTA

Minneapolis.....Martin F. Falk Paper Co.
Duluth.....Martin F. Falk Paper Co.

MISSOURI

Joplin.....Joplin Paper Co.
Kansas City.....Bossert Company
Kansas City.....Wertgame Paper Co.
Kirkwood.....Industrial Ideas
St. Louis.....Royal Papers, Inc.
St. Louis.....Rubber Products Corp.

MONTANA

Billings.....Winter Hardware Co.

NEBRASKA

Omaha.....Nogg Bros. Paper Co.
Clifton.....Ralph E. Baker Co.

NEW JERSEY

Elizabeth.....Hand Hardware
Englewood.....Coronet Paper Corp.
Hoboken.....D. S. MacCorkle, Inc.
Newark.....Abco Plastic & Supply Co.
Newark.....Herbert A. Post, Inc.
Paterson.....Theodore R. Levine & Sons
Ridgefield.....George H. Swatek
Trenton.....Pack & Seal, Inc.

NEW MEXICO

Albuquerque.....Equipment Sales & Mfg. Co.

NEW YORK

Astoria, L. I.....Herbert A. Post, Inc.
Buffalo.....Hartfield-Healy Supply Co.
Buffalo.....Presque Isle Paper Products
Buffalo.....Union Paper & Twine Co.
Cohoes.....Shoemaker Paper Co.
Garden City, L. I.....Hogan Industrial Supply Corp.
Elmira.....Waight Supply Co.
Elmira Heights.....The Welles Supply Co.
Jamaica.....Pacific Supply Co.
Long Island City..Viking-Criterion Paper Corp.
New York.....Coy Disbrow, Div. of Pohlman Co., Inc.
New York.....Geo. W. Millar & Co., Inc.
New York.....Robert Spector Co.
New York.....Westwood Paper Co., Inc.
Rochester.....The Mill Andrews Paper Co.
Syracuse.....Allied Products
Troy.....Sperry Supply Corp.
Utica.....Smyth-Despard Co.

NORTH CAROLINA

Charlotte.....Dillard Paper Co.
Greensboro.....Dillard Paper Co.
Raleigh.....Dillard Paper Co.

OHIO

Cincinnati.....The Chatfield Paper Corp.
Cleveland.....The Central Ohio Paper Co.
Cleveland.....Gascon Paper Co.
Cleveland.....Union Paper & Twine Co.
Columbus..The Cincinnati Cordage & Paper Co.
Dayton.....Reliable Rubber Products Co.
Hubbard.....Federal Wholesale Co.
Toledo.....The Ohio & Michigan Paper Co.
Youngstown.....The Hearn Paper Co.

OKLAHOMA

Oklahoma City.....C. B. Anderson Co.
Oklahoma City.....Service Supply Co.
Tulsa.....C. B. Anderson Electric Co.
Tulsa.....Industrial Equipment Co.
Tulsa.....Tulsa Paper Co.

OREGON

Portland.....Western Fibrous Glass Products
Portland.....General Rubber & Supply Co.

PENNSYLVANIA

Hershey.....Hershey Paper Co.
Johnstown.....Morris Paper Co.
Lancaster.....United Twine & Paper Co.
Philadelphia.....The J. L. N. Smythe Co.
Philadelphia.....Frank W. Winne & Son, Inc.
Pittsburgh.....The Chatfield & Woods Co.
Pittsburgh.....Interstate Cordage & Paper Co.
Pittsburgh.....Morris Paper Co.
Scranton.....Stan-Tone
Springfield.....The Baeod Co.

RHODE ISLAND

Providence.....J. C. Campbell Co.

SOUTH CAROLINA

Greenville.....Dillard Paper Co.

TENNESSEE

Knoxville.....Dillard Paper Co.
Knoxville..The Cincinnati Cordage & Paper Co.
Memphis.....Mayer Myers Paper Co.
Nashville.....Clements Paper Co.

TEXAS

Dallas.....Airsco Rubber Prod. of Dallas, Inc.
El Paso.....Field Parker Co.
Grand Prairie....C. P. Waggoner Sales Co., Inc.
Houston.....Frank W. Winne & Son, Inc.

UTAH

Salt Lake City....American Paper & Supply Co.
Salt Lake City.....Equipment Supply Co.
Salt Lake City.....Great Western Supply Co.
Salt Lake City.....J. B. Tile Co.

VIRGINIA

Bristol.....Dillard Paper Co.
Norfolk.....Empire Machinery & Supply Co.
Norfolk.....J. Henry Holland Corp.
Richmond.....Industrial Supply Corp.
Roanoke.....Dillard Paper Co.

WASHINGTON

Seattle.....Marinco Supply Inc.
Seattle.....Western Fibrous Glass Products
Spokane.....Zellerbach Paper Co.

WISCONSIN

Appleton.....Universal Paper Co.
Madison.....Schwarz Paper Co.
Milwaukee.....F. D. Haker Co.
Milwaukee.....Redi-Products Company
Milwaukee.....Reliable Paper Co., Inc.
Neenah.....Sawyer Paper Co.

HAWAII

Honolulu.....Chapson Bros. Ltd.
Honolulu.....The Thom Co., Inc.

WALTER KIDDE & COMPANY, INC.

(See Page 200)
675 MAIN STREET, BELLEVILLE 9, N. J.

CALIFORNIA

Los Angeles.....4845 W. Exposition Blvd. REpublic 3-0158

GEORGIA

Atlanta.....1882 Marietta Blvd., N.W. P.O. Box 2594, Sta. "D" SYcamore 9-5381

ILLINOIS

Chicago.....1310-20 W. Randolph St SEeley 8-2724

MASSACHUSETTS

Boston.....258 Park Square Bldg. HAncock 6-2853

MICHIGAN

Detroit.....20850 Coolidge Highway JOrdan 6-6388

PENNSYLVANIA

Philadelphia.....101 North 33rd Street BAring 2-8181

TEXAS

Dallas.....7224 Harry Hines Blvd. FLeetwood 1-6466

KOPPERS COMPANY, INC.

TAR PRODUCTS DIVISION

(See Page 257)
PITTSBURGH 19, PA.

ALABAMA

Birmingham.....**Industrial Mastic Co.
Ross Sales Co.
Mobile 8.....Marine Specialty Co., Inc.
Montgomery.....R & H Supply Co.

ARIZONA

Phoenix.....*Rust-Proofing, Inc.

ARKANSAS

Crossett.....Tri-State Mill Supply
Little Rock.....*The Paint House

CALIFORNIA

Fresno.....Valley Pipe & Supply Co.
Long Beach.....Industrial Paint Co.
Long Beach 13.....**Crosby & Overton Ship Maint. Co. (Calblasco, Inc.)
Los Angeles 23.....Bradley Paint Co.
Los Angeles 58.....Howard Supply Co.
Los Angeles 13....L. A. Rubber & Asbestos Co.
Los Angeles 22.....*Parker Engineering Co.
Oakland.....Howard Supply Co.
Richmond.....*Bituminous Products & Application Co.
San Diego 6.....C. J. Hendry Co.
San Diego 1.....Industries Supply, Inc.
San Francisco 5.....Anchor Equipment Co.
San Francisco 9.....**D. E. Burgess
San Francisco 4.....C. J. Hendry Co.
San Francisco 5.....Pan Pacific Supplies
San Francisco 24.....*A. R. Reid Co.
San Jose 10 .....Coast Pipe & Supply Co.
San Pedro.....C. J. Hendry Co.
Torrance.....*Spence & Sullivan, Inc.
Wilmington.....*Service Coating Corp.

COLORADO

Denver.....Colorado Industrial Supply Co.
Protecto Wrap Co.
Grand Junction....Pacific & Western Industrial Supply Co.

CONNECTICUT

Bridgeport.....Lindquist Hardware Co.
Hartford.....L. L. Ensworth & Sons
New Haven.....C. S. Mersick & Co.
New London.....Hansen Supply Co.
North Haven.....Copeland Co.
Waterbury.....Verriker Paint Co.
West Haven.....Gerber & Hurley, Inc.

DELAWARE

Wilmington.....Canby C. Mammele, Inc.

DISTRICT OF COLUMBIA

Washington 4.....Max Greenwald
Washington 2.....Thomas Somerville Co.

FLORIDA

Jacksonville.....M. O. Huck Co.
Jacksonville 6....*Industrial Marine Supply Co.
Miami 36.....*Robert F. Riley, Inc.
Miami 37.....Jerome A. Taudte Co.
Pensacola.....Ferris Distributing Co.
W. W. Henderson & Sons
Tampa 4.....*Heat & Frost Insulation Co.
West Palm Beach.....Hopkins Marine Hardware Co.

GEORGIA

Atlanta.....Southern Lead Burning Co.
Atlanta 9.....Steele & Associates
Columbus.....S. A. Nielsen
Macon.....Macon Supply Co.
Savannah.....White Hardware Co.

ILLINOIS

Chicago 1.....Continental Supply Co.
Chicago.....**Knickerbocker Roofing & Paving Co.
Chicago.....**B. Pedersen Co.
Chicago 6.....Ludwig Wilson Co.
Lombard.....Protecto Wrap Co.
Mt. Vernon.....Mid States Chemical Co., Inc.
Salem.....**Henry T. Reed Construction Co.

INDIANA

Evansville.....Collins Engineering Associates
Fort Wayne.....Dahm Brothers
Indianapolis.....Fire Brick Service Co.
South Bend.....Bob Rans Wholesale, Inc.

(Turn the page)

(Koppers Co.—cont'd)

IOWA

Cedar Rapids.....Ar-Jay Building Products
Davenport.....Harry Alter & Sons
Des Moines 13.....Ace Supply Co.

KENTUCKY

Louisville 2.....Robert L. Schmitt Co.
Madisonville.....Austin Power Co.
Paducah.....Hannan Supply Co.

LOUISIANA

Gretna.....Mavor-Kelly Co.
New Orleans.....Marine Specialty & Mill Supply Co.

MAINE

Portland.....W. L. Blake & Co.
**Commercial Welding Co.

MARYLAND

Baltimore 31.....Budeke's, Inc.
Baltimore 2.....James Walker Co.
Cumberland.....Builders Paint & Supply Co.
Tuxedo.....Max Greenwald & Sons

MASSACHUSETTS

Boston 10.....Curry Oil Co.
Cambridge.....**A. Belanger & Sons Co.
Clinton.....Scott Brothers Surprenant Manufacturing Co.
Dorchester....**Fireproofing Corp. of America
Framingham.....**Roy O. Leonard
Lynn.....Lynn Builders Supply Co.
Newton Highlands 61.....Harlow-Imrie Corp.
Randolph.....**Ernest C. Martin Co.
Springfield.....Charles C. Lewis Co.
Worcester.....Brierly Lombard & Co., Inc.
Worcester 8.....Municipal Services, Inc.
Worcester 7.....Technical Coatings, Inc.

MICHIGAN

Detroit 7.....Bockstanz Brothers, Inc.
Detroit 17.....*J. H. LaPrete & Associates
Detroit 25.....*Spray-Coat Engineers, Inc.
Detroit .....**Ben T. Young Co.
Grand Rapids.....P. B. Gast & Son Co.
Saginaw.....Morley Brothers

MINNESOTA

Minneapolis 5.....George R. Lewis Co.
Minneapolis 14.....Smith-Sharpe Co.
St. Paul.....Inland Supply Co.

MISSISSIPPI

Jackson.....Protective Paint Co., Inc.
Pascagoula.....Marine Sales & Service

MISSOURI

Kansas City 8.....A. P. Green Fire Brick Co.
Kansas City 27.....Industrial Coatings Engineering Co.
Kansas City 41.....Waggener Paint Co.
St. Louis 4.....*Protective Coatings Co.

NEBRASKA

Omaha 2.....Scaco, Inc.

NEW HAMPSHIRE

Manchester.....Cohen Machinery Co.
Emery-Waterhouse Co.

NEW JERSEY

Atlantic City.....Joseph Soltz Paint Store
Belleville.....Kane Brothers Co.
Newark.....Seither & Ellis, Inc.
Union.....Charles V. Lester Co.
Wallington.....Smith Bercall Co.

NEW YORK

Albany 4.....Albany Steel & Iron Supply
Binghamton.....Ellis W. Morse Co.
Brooklyn.....**Abar Co.
Debevoise Co.
Kasper & Koetzle
Buffalo 5.....Beals, McCarthy & Rogers, Inc.
Falconer.....Laco Roofing & Asbestos Co., Inc.
Lynbrook, L. I.....**Railroad Waterproofing
Newburgh.....W. L. Smith
New York.....*G. & G. Duct Cleaning & Rustproofing, Inc.
Rochester.....Follansbee Metals Corp.
Syracuse 1.....Burns Piping & Supply
Utica.....John A. Scanlon Supply Co.

NORTH CAROLINA

Charlotte.....A. Lynn Thomas Co.
Raleigh.....A. Lynn Thomas Co.
Wilmington.....Wilmington Iron Works

OHIO

Akron.....M. F. Murdock Co.
Canton.....R. G. Smith Co.
Cincinnati 15.....Cincinnati Supply Co.
Cleveland 28.....Industrial Roofing & Sheet Metal, Inc.
Columbus 8.....Central Ohio Services, Inc.
Columbus.....Southard Supply Co.
Dayton.....M. D. Larkin Co.
Lima.....Utility & Industrial Supply Co.
Marietta.....McJunkin Corp.
Portsmouth.....Standard Supply Co.
Toledo.....Shaw-Kendall Engineering Co.
**Tomlin-Toledo Co.
Zanesville.....Buckeye Supply Co.

OKLAHOMA

Oklahoma City.....*Standard Roofing & Material Co.
Tulsa.....J. J. Clancy Co.

OREGON

Portland.....*Northwest Protective Coatings, Inc.
Rodda Paint Co.

PENNSYLVANIA

Allentown.....I. E. Frey Co.
Bradford.....Bradford Supply Co.
Erie.....Laco McMullen Co.
Franklin.....H. T. Osborne
Harrisburg.....Smith Paint Products
Lancaster.....Herr and Co.
Langhorne.....W. A. Briggs Co.
Philadelphia 34.....*Enoch Brothers Paints
Philadelphia 20.....McArdle & Cooney
Pittsburgh 30.....John Flocker and Co.
Pittsburgh.....**Johnson Brothers Co.
Pittsburgh 22.....**Rust Engineering Co., Inc.
Pittsburgh 16.....Sirod Engineering, Inc.
Pittsburgh 12.....Supplies, Inc.
Scranton.....Gaylord & Butler Co.

RHODE ISLAND

Pawtucket.....Industrial Specialties Co., Inc.
Providence 3.....Brian Supply Co., Inc.
Providence.....Plumb Bituminous Dist., Inc.
Providence 5.....Read & Lundy, Inc.

SOUTH CAROLINA

Charleston.....*Southeastern Supply Co.
Columbia.....Thackston-Davis Supply Co.

TENNESSEE

Chattanooga.....Brooks Welding Supply Co.
Southeastern, Inc.
Knoxville.....Southeastern, Inc.
Memphis.....John A. Denie's Sons Co.
J. E. Dilworth, Co.
Nashville.....Southeastern, Inc.

TEXAS

Houston 2.....Mavor-Kelly Co.

UTAH

Salt Lake City.....Peck-Ash-Parry Co.
Salt Lake City.....**Wiscombe Painting Co.

VIRGINIA

Newport News.....Noland Company, Inc.
Norfolk.....Noland Company, Inc.
Richmond.....Industrial Supply Corp.
Richmond.....A. Lynn Thomas Co.
Roanoke 10.....Noland Company, Inc.

VERMONT

Burlington.....Dennison, Inc.

WASHINGTON

Seattle 9.....Palmer Supply Co.
Seattle 88.....*Runnels Paint Co.
Spokane 1.....Coatings, Inc.
Tacoma.....**Larson Brothers Painting Co.

WEST VIRGINIA

Charleston.....McJunkin Corp.

WISCONSIN

Milwaukee 4.....Fire Brick Engineers Co.
Milwaukee 12.....Spray-O-Bond Co.

* Distributor—Applicator
** Approved Applicator

PRODUCTS FOR INDUSTRY, INC.

(See Page 14)
1530 SUMMER STREET, STAMFORD, CONN.

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Phoenix.....Complete Industrial Supply, Inc.
Tuscon.....Complete Industrial Supply, Inc.

CALIFORNIA

Los Angeles 23.....McKinley Equipment Corp.
San Francisco 11.....Enterprise Commercial Co.

COLORADO

Thornton.....Equipment Engineering

CONNECTICUT

Branford.....The S. L. Cooke Company

FLORIDA

Orlando.....Atlas Material Handling Co.

ILLINOIS

Chicago 44.....Robert F. Schuler
Rock Island.....Dikcon Company

INDIANA

Indianapolis 2.....Indiana Material Handling Products, Inc.

KENTUCKY

Louisville.....Kleimeyer Equipment Co.

MARYLAND

Baltimore 27.....Yankee Engineering Co., Inc.

MASSACHUSETTS

Boston 27.....Barry Hyman Company, Inc.

MICHIGAN

Detroit 27.....Kenmac Corporation

MINNESOTA

Minneapolis 4.....Robert J. Pugleasa Co.

MISSOURI

Kansas City 11.....Heubel Material Handling Equip.

NEW YORK

Buffalo.....Lanich-Schreiner Co.
Kew Gardens 15.....Axiom Products Co., Inc.
Schenectady.....Schenectady Materials Handling Co., Inc.
Syracuse.....Material Handling Products Corp.

OHIO

Cincinnati.....Scott Material Handling Co.
Cleveland 20.....W. B. Mc Clelland Co.
Columbus.....Scott Material Handling Co.
Dayton 4.....Scott Material Handling Co.
Toledo 2.....Schenk Equipment Co.

PENNSYLVANIA

Philadelphia 19.....Stokes Equipment Co.
Scranton.....Harry Strong
York.....Automation Sales & Engineering Inc.

TEXAS

Dallas 35.....Allied Material Handling Systems, Inc.

WISCONSIN

Milwaukee 4.....Rowe Equipment Co.

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It's far cooler, cleaner and more comfortable. That's how to describe the new-type face shield being used by workers at the Chula Vista and Riverside (Calif.) plants of Rohr Aircraft Corporation.

All Rohr cribs now stock the new shield, equipped with a nylon adjustable headband. This is both cooler and more sanitary than the older type fiberboard band. And as an added safety feature, the new face shield has a plastic bib attached to the clear plastic face plate. This protects the neck and chest.

FACTORY

PUROLATOR PRODUCTS, INC.

(See Page 48)
RAHWAY, NEW JERSEY

CALIFORNIA
Northern (Bay Area)....Jay Besore & Associates
380 Bayshore Boulevard
San Francisco
Southern (L. A. Area).....Pump Engineering Co.
2011 So. Sante Fe Avenue
Los Angeles

COLORADO
Denver 4.....Goble & Sampson
1198 Stout Street

DELAWARE
(State).....Sheffler Gross Company
121 North Broad Street
Philadelphia 7, Penna.

ILLINOIS
Chicago 45.....Purolator Products, Inc.
5955 N. Rockwell Street

INDIANA
(Northern).....Coffield Supply Company
1026 South Main Street
South Bend, Indiana
(Central & South).....Gorske Industrial Equip.
132 E. 30th Street
Indianapolis, Indiana

LOUISIANA
New Orleans.....Rittiner Equipment Company
600 Tchoupitoulas Street

MASSACHUSETTS
(Eastern).....Phelps Engineering Services
P. O. Box 125
South Weymouth, Mass.
(Western).....V. Holm-Hansen
17 Centerbrook Place
Fairfield, Connecticut

MICHIGAN
Detroit 2.....Agren-Ascher Company
5-121 General Motors Bldg.
(Southwestern).....Coffield Supply Company
1026 South Main Street
South Bend, Indiana

MINNESOTA
Minneapolis.....Zahl Equipment Company
1516 South 5th Street

NEVADA
(State).....Jay Besore & Associates
380 Bayshore Boulevard
San Francisco, California

NEW JERSEY
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Philadelphia, Penna.

NEW MEXICO
Albuquerque.....Hohlhaas Tank &
Equipment Co.
P. O. Box 1416

NEW YORK
(State).....G. H. Owens Company
P. O. Box 182
Syracuse, New York
(Metropolitan).....Alpha Engrg. Specialty Co.
15 Park Row
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OHIO
(Northern).....E. C. Swift Company
3537 Lee Road
Cleveland 20, Ohio
(Southern).....Rawdon Myers Agency
Roselawn Center Bldg.
Cincinnati 37, Ohio

PENNSYLVANIA
(Eastern).....Sheffler Gross Company
121 North Broad Street
Philadelphia 7, Penna.
(Western).....Edwards & Company
300 Mt. Lebanon Blvd.
Pittsburgh, Penna.

TEXAS
Dallas.....Bratten Engineering Co.
910 South Lamar
Houston.....208 South 75th Street

WASHINGTON
Seattle 5.....D. A. Olson Company
4600 Union Bay Place

WEST VIRGINIA
(State).....Edwards & Company
300 Mt. Lebanon Blvd.
Pittsburgh, Penna.

WISCONSIN
Milwaukee.....B. E. Searle
9373 No. Lake Drive

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(ARKANSAS, OKLAHOMA).....Allan Edwards
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(CONNECTICUT, VERMONT).....V. Holm-Hansen
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4010 Washington St.
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(MAINE, N. HAMPSHIRE, RHODE ISLAND) Phelps Engrg. Services
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South Weymouth, Mass.

RADIO CORPORATION OF AMERICA

(See Page 250)

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(See Page 96)
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Los Angeles.....UPton 0-5814
San Francisco.....MIssion 8-4625

COLORADO
Denver.....MAin 3-3924

GEORGIA
Atlanta.....TRinity 5-8846

ILLINOIS
Chicago.....MAnsfield 6-7456
(Suburban) FIllmore 5-5150

INDIANA
Indianapolis.....CLifford 3-2152

MASSACHUSETTS
Boston.....ALgonquin 4-8400

MICHIGAN
Detroit.....UNiversity 4-9373

MINNESOTA
Minneapolis.....FEderal 3-8271

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St. Louis.....MIssion 7-3444

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New York.....ATlas 8-1700
PEnnsylvania 6-9767

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OHIO
Cincinnati.....REdwood 1-7117
Cleveland.....YEllowstone 2-1340

OKLAHOMA
Tulsa.....Diamond 3-1097

OREGON
Portland.....CApitol 8-4309

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Philadelphia.....GArfield 6-9620
Pittsburgh.....FOrest 4-2500
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RIchmond 7-4141

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(Turn the page)

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AD. 3-1255

Los Angeles 21.....*Irving G. King & Co.
821 Mateo St.
MA. 6-5361

Oakland 7.....T-G Forklift Sales Co.
699 Fourth St.
TW. 3-3668

San Diego.....*Irving G. King & Co.
1646 India St.
BE 9-5196

San Jose.....T-G Forklift Sales Co.
1230 N. 13th St.
CY. 3-9123

Van Nuys.....**Power Equipment Co.
15220 Erwin St.
RI 9-6331

COLORADO

Denver 4.....Murray Equipment Co.
16 Wazee Market
KE 4-5296

CONNECTICUT

Bridgeport 5.....H. G. Davis, Inc.
195 Dewey St.
FO. 7-7427

FLORIDA

Jacksonville 7.....Consolidated Service Co.
400 N. Myrtle Ave.
EL. 4-3661

Miami.....Watkins Material Handling Corp.
2215 N W Miami Court
FR. 1-8258

Tampa.....Pupello Lift Trucks Sales & Service
1155 E. Cass St.
2-8634

GEORGIA

Atlanta.....The Bailey Co., Inc. of Georgia
1033 Ridge Avenue, S. W.
JA 4-1956

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Chicago 17.....Towmotor Corporation
2940 E. 96th St.
So. Chgo. 8-7300
North Chicago Area
4221 N. Nordica Ave.
GL 7-0121

Rockford.....Lawrence O. Whybark Co., Inc.
1615 Kilburn Ave.
WO. 8-9801

Rock Island....Midland Truck & Equipment, Inc.
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RI. 8-8235

INDIANA

Indianapolis 22.....Kidney-Wood Co., Inc.
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ME. 7-1593

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1310 Prairie Ave.
AT. 8-4631

IOWA

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8-0611

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JU. 3-8306

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EX. 2154

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SP. 2-3621

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CH. 3-0900
Towmotor Corporation
Factory Service Branch
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BE. 5-6750

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UN. 4-7550

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Detroit 14.....The Modern Handling Equipment Co.
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WA. 5-6000
Towmotor Corporation
Factory Service Branch
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WA. 5-2520

Flint.....The Modern Handling Equipment Co.
c/o Michigan Equipment & Parts Co.
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CE. 4-8723

Grand Rapids 8.....Towmotor Corporation
Factory Service Branch
362-44th St., S. W.
GL 2-1212

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3106 E. Belt Line Highway

Minneapolis 6.....Industrial Truck Division
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MI 6-4591

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GR. 1-1540

St. Louis 9..Wiese Planning & Engineering, Inc.
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NO. 3-2800

Newark.....A. A. Moore, Inc.
Building 186 (South Side)
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Port Newark
MI. 2-1822
Towmotor Corporation
Factory Service Branch
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MA. 3-3117

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922-926 Broadway
3-2189

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133 Hopkins St.
SO. 7865

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2079 Hillside Ave.
HU 2-1822
Towmotor Corporation
Factory Service Branch
2079 Hillside Ave.
HU 3-3050

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WA. 4-0070
Towmotor Corporation
Factory Service Branch
111 Leroy St.
OR. 5-9330

Rochester 23.....William Thom & Co., Inc.
900 Jefferson Road
BR 1-9931

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119 Seeley Road
GR. 5-1695

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3637 Hutchison Ave.
ED. 3-0397

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P.O. Box 10487
TE 4-8411

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Cincinnati 14.....Gilbert Mann Co.
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PO. 1-6250

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BA. 4-6897

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KE 4-1973

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RE 9-2541

Tulsa.....Hart Industrial Supply of Tulsa, Inc.
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LU 4-0311

OREGON

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MA 3-2391

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Factory Service Branch
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GR. 1-2022
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Factory Service Branch
3561 Valley Drive
LO. 3-1013

Reading.....Towmotor Corporation
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FR. 6-5471

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North Pleasantburg Drive
CE. 3-2745

Sumter.....B. L. Montague Co., Inc.
E. Liberty St.
SP 3-3311

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St 6-5276

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MA. 2-1171

Johnson City.....Lancaster Associates
John Sevier Hotel Building
3200

Knoxville.....Lancaster Associates
1742 Euclid Ave.
4-4623

Memphis.....Grady W. Jones. Co.
1082 Union Ave.
BR. 6-6363

Nashville.....The Bailey Co., Inc.
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CH. 2-0351

TEXAS

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5508 Redifield Road
LA. 8-6195

El Paso.....Associated Supply Co.
1034 Humble Drive
PR 8-2101

Houston.....L. M. Coates Co.
5702 Navigation Blvd.
WA. 8-3391

Lubbock.....Associated Supply Co.
2402 Ave. H
PO. 3-5031

San Antonio.....Gus Schmidt Industrial Trucks
2911 E. Houston St.
CA. 7-4611

UTAH

Ogden.....The Horsley Co.
2416 Grant Ave.
EX. 3-8477

VIRGINIA

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Towmotor Corporation
Factory Service Branch
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MA. 7-0525

Richmond.....Reliance Equipment & Supply Co.
705 Jefferson Davis Highway
(Petersburg Pike)
BE. 3-1927

Roanoke.....Reliance Equipment & Supply Co.
1531 Shenandoah Ave, N.W.
DI. 4-7672

WASHINGTON

Seattle 4.....Air-Mac, Inc.
3838 - 4th South
MU. 2-3388

Spokane.....Air-Mac, Inc.
E. 3710 Trent Ave.
KE. 5-2005

Tacoma 2.....Air-Mac, Inc.
1003 Washington Bldg.
BR 2-5388

Yakima.....Air-Mac, Inc.
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CH 8-0777

WEST VIRGINIA

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P.O. Box 489
JA. 9-7135

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89-5521

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BA. 9777

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CH 5121

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GE 2-5856

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127 McIntyre St.
GR 2-7950

Ottawa.....Watson Jack-Hopkins, Ltd.
2116 Scott St.
PA 2-3431

Toronto.....Canadian Lift Truck Co., Ltd.
163 Wicksteed Ave.
HU. 1-5296

QUEBEC

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CR. 4-4337

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(See Page 239)

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MIssion 8-3783

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Denver 16.....4800 Colorado Blvd.
DUdley 8-2481

GEORGIA

Atlanta 2.....999 Lee St., S.W.
PLaza 5-6631

ILLINOIS

Chicago 32.....4135 So. Pulaski Rd.
CLiffside 4-5700

MARYLAND

Baltimore 5.....500 N. North Point Rd.
EAstern 7-0085

LOUISIANA

New Orleans 25....900 S. Jefferson Davis Pkwy.
GAlvez 2131

MASSACHUSETTS

Boston (Dedham).....100 Route 128
DAvis 6-6000

MICHIGAN

Detroit 16.....2121 West Fort St.
TAshmoo 6-2121

MINNESOTA

Minneapolis 1.....400 Second Ave. North
FEderal 2-8251

MISSOURI

No. Kansas City 16.....16th & Swift Aves.
GRand 1-3575

NEBRASKA

Omaha 2.....6847 North 16th St.
PRospect 4030

NEW YORK

Buffalo 3.....133 East Swan St.
WAshington 0827

New York (Passaic, N. J.).....1 Market Street
PRescott 7-4400

OKLAHOMA

Tulsa 4.....1132 So. Lewis Ave.
WEbster 9-6335

PENNSYLVANIA

Pittsburgh (McKees Rocks).....Royal Drive
& Graham St.
SPalding 1-3500

TEXAS

Dallas 35.....1011 Regal Row
FLeetwood 2-2651

Houston 17.....6654 Gulf Freeway
MIssion 4-5311

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38—Modular Bench System
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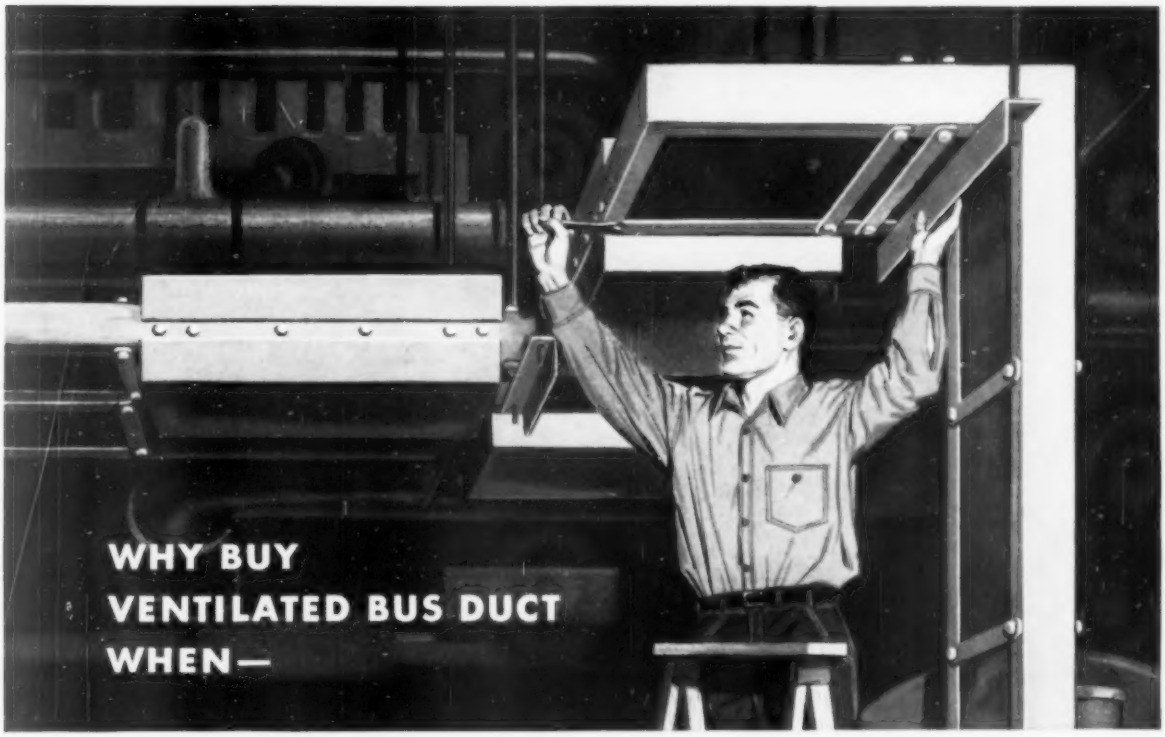
62—San Mateo, Calif.
63—Vermont
64—Upstate New York



Square D TOTALLY ENCLOSED Duct*

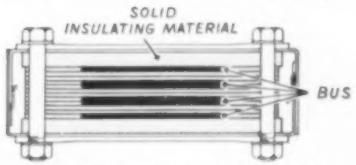
mounts in any position without de-rating

—*and costs no more*

*(low impedance)

Square D totally enclosed low-impedance bus duct mounts in any position without de-rating, because it doesn't need ventilation. Moreover, you can have all the advantages of totally enclosed duct without the price penalty of a "special," because all Square D low-impedance bus duct is totally enclosed. Square D feed-in duct has no ventilation holes, is protected from physical damage and dust accumulation. It's smaller than ventilated duct by as much as 50%. Doesn't it make sense, when buying low-impedance duct, to specify a product that meets every one of your requirements? Square D totally enclosed low-impedance duct costs no more —why settle for less?

Here's Why Square D's EXCLUSIVE Design makes ventilation unnecessary



The entire space within the duct and between the bus bars is filled with a solid insulating material which conducts the heat to the surface. There are no dead air spaces inside the duct. Square D totally enclosed low-impedance duct is listed with Underwriters' Laboratories and meets U/L requirements for temperature rise in any mounting position.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

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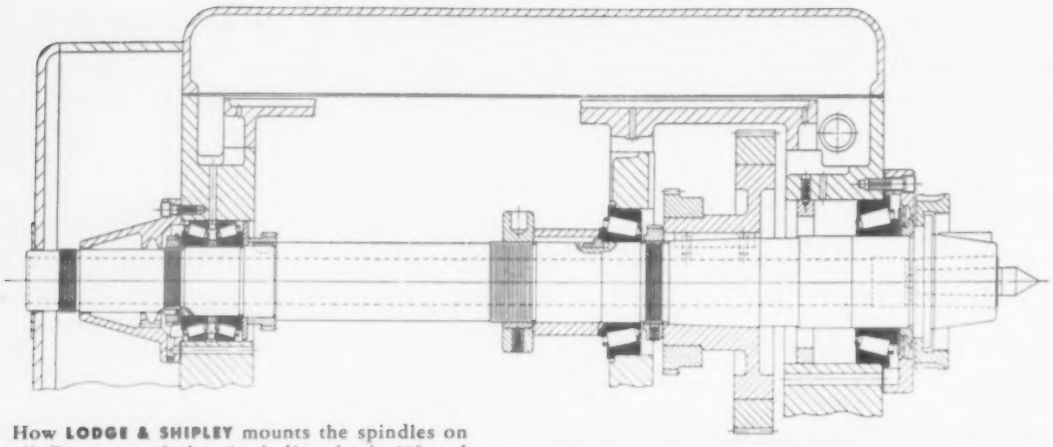

How **LODGE & SHIPLEY** mounts the spindles on all Powerturn lathes including both 45° and 90° Copymatics on Timken bearings to get extra rigidity, maintain accuracy, reduce maintenance.

New type lathe ups production 200%, saves users an estimated $8,000 a year

...one secret—TIMKEN® bearings on the spindle

"Production increases as high as 200%"..."Overall savings estimated at $8,000 a year"—read user reports about the new Powerturn 90° Copymatic Lathe. One important reason for such exceptional results is that Lodge & Shipley mounts the spindle on Timken® tapered roller bearings. Timken bearings give it the vital extra rigidity and hold runout to the minimum needed for tracer accuracy.

How spindle is held rigid. Timken bearings hold the spindle in positive alignment. They take *both* radial and thrust loads in any combination, because of their tapered design. And because of full-line contact between rollers and races, Timken bearings have extra load-carrying capacity.

Why heavy shocks are absorbed. Case-carburization of Timken bearings' rollers and races gives them hard, wear-resistant surfaces and tough, shock-resistant cores.

How friction is virtually eliminated. Timken bearings are geometrically designed to roll true. And they're precision-made to live up to their design. They run smoother—last longer.

We even make our own electric furnace fine alloy steel, for extra quality control. We're America's only bearing maker that does. To get all these advantages, always specify bearings trade-marked "TIMKEN". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

BETTER-ness rolls on TIMKEN® tapered roller bearings

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